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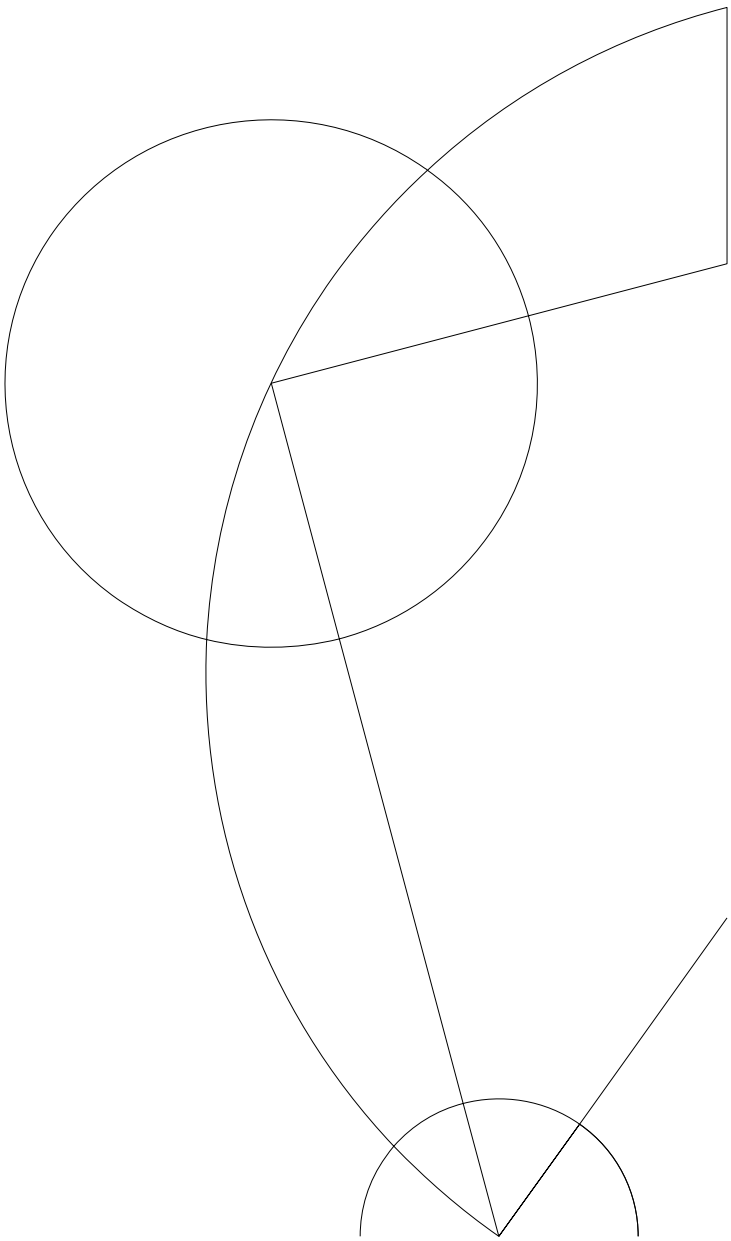
Talent – Why do we do it?



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32. Henrik Egholm Wessel: Smartphones as Scientific Instruments in Inquiry Based Science Education (2013)
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34. Trine Louise Brøndt Nielsen: From Master's programme to labour market – A study on physics graduates' experience of the transition to the labour market (2013**)**
35. Rie Hjørnegaard Malm: Becoming a Geologist – Identity negotiations among first year geology students (2013)
36. Mariam Babrakzai Zadran: Gymnasiealgebra I et historisk perspektiv – Matematiske organisationer I gymnasiealgebra (2014)
37. Marie Lohmann-Jensen: Flipped Classroom – andet end blot en strukturel ændring af undervisningen? (2014)
38. **Jeppe Willads Petersen: Talent – Why do we do it? (2014)**

Abstract

In 2005 three reasons were given for why talent development should be done in Denmark. With a basis in these reasons this thesis asks four questions about talent development: what should we do, who should we do it for, what are we doing and who are we doing it for?

These questions are sought to be answered through a review on the literature of talent, giftedness and expertise, a study of the aims and formats of current talent activities in Denmark and a longitudinal study of a new talent activity in Ordrup, Denmark.

The literature review reveals a long history of research on the subject that points in many directions and has difficulties agreeing on a common definition of the target group. The study of talent activities leads to a classification of the talent activities into three groups based on the aim of the activities. The longitudinal study uses a concept called the implied students to analyse how the image of the future students evolves during the initiation of the activity.

The results indicate that the concept of talent in a Danish context relies on motivation and high performance as key identifiers. The talent activities are primarily of a competitive format and focus mostly on only one of the three reasons for doing talent activities.

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TALENT - WHY DO WE DO IT?

JEPPE WILLADS PETERSEN

A Master's Thesis in Science Education

August 2014

A third finds in himself a talent which with the help of some culture might make him a useful man in many respects. But he finds himself in comfortable circumstances, and prefers to indulge in pleasure rather than to take pains in enlarging and improving his happy natural capacities. He asks, however, whether his maxim of neglect of his natural gifts, besides agreeing with his inclination to indulgence, agrees also with what is called duty. [...] but he cannot possibly will that this should be a universal law of nature, or be implanted in us as such by a natural instinct. For, as a rational being, he necessarily wills that his faculties be developed, since they serve him, and have been given him, for all sorts of possible purposes.

— Immanuel Kant

ABSTRACT

In 2005 three reasons were given for why talent development should be done in Denmark. With a basis in these reasons this thesis asks four questions about talent development: what should we do, who should we do it for, what are we doing and who are we doing it for?

These questions are sought to be answered through a review on the literature of talent, giftedness and expertise, a study of the aims and formats of current talent activities in Denmark and a longitudinal study of a new talent activity in Ordrup, Denmark.

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CONTENTS

LIST OF FIGURES

ACRONYMS

ATU Akademiet for Talentfulde Unge (The Academy for Talented Youngsters)

Bagkost Bagsværd Kostskole og Gymnasium

BMSF Børn med særlige forudsætninger (children with special prerequisites)

DMGT Differentiated Model of Giftedness and Talent

DTU Danmarks Tekniske Universitet (The Technical University of Denmark)

EUCYS European Union Contest for Young Scientists

IMO International Mathematics Olympiad

IOI International Olympiad of Informatics

IQ Intelligence quotient

UAG Underachieving gifted

UNF Ungdommens Naturvidenskabelige Forening (The Danish Youth Association of Science)

WISC Wechsler Intelligence Scale for Children

1 INTRODUCTION

Why bother? There are plenty of students who are struggling so why should we split our focus to also include the talented? In other words: why bother do something for the great when there are students in need?

In Denmark we started asking this question in 2005 and three reasons came up (ScienceTalenter, n.d.):

- Globalisation creates a demand for talents
- Talent is contagious and inspires the other students
- Talent development increases the wellbeing of the talented

Five years later a lot of new activities for the talents had emerged and a report was made on the effects of talent development and with recommendations for the future (Hermann et al., 2011). Soon another five years have passed and ScienceTalenter, the coordinator of the national effort in talent development, is about to be evaluated (ScienceTalenter, 2013).

As it turns out Denmark is not a forerunner in this field. Research on giftedness and talent goes more than a hundred years back. There has been made many models for and definitions of giftedness and talent and there has been a particularly large interest in the educational context of giftedness and talent.

1.1 RESEARCH QUESTIONS

Since we already know why we should bother do something for the talents perhaps it is time to ask *what we should be bothered to do* and *who we should do it for*, so that we can become more effective in our efforts. This leads to the questions of *what we are doing* and *who we are doing that for*, which must be known before we can start to change towards a more effective effort in talent development. Those are the main questions of this thesis.

To answer these questions I have decided to focus on three things. One is what is already known about giftedness and talent. The second is what is being done in Denmark. The third is who these activities are directed at.

More specifically I have made a literature review to answer the questions of what we should do and who we should be doing it for. After this I have taken a closer look at the talent activities in Denmark, what their aims are and how the format of an activity reflects its aims.

This was done to get a clear view of what is being done in Denmark. Finally to figure out who the activities are directed at I have made a longitudinal study of a new talent activity in its initial phases to get a sense of how the idea of talent develops in the minds of teachers and other organisers of talent activities and what that might mean for the activities we end up with.

1.2 THE STRUCTURE OF THIS THESIS

There are three parts of this thesis: a literature review, an analysis of talent activities in Denmark and a longitudinal study of a biotech class. Each part is more or less independent though references are made to sections of other parts.

The literature review is the foundation for reading the other parts and gives an overview of what this field is, what the major topics are and why certain aspects get an extra amount of attention. It sets the context for the thesis.

In the analysis of talent activities in Denmark I make a long list of talent activities and analyse them based on their format and aims in order to get a sense of what we are doing for the talented and what it might tell us about who we are doing it for. At the end of this part I give a few recommendations as to how the combined effort can be improved and relate the effort to previous recommendations from other reports and the new reform of the schools.

In the longitudinal study of the new biotech class in Ordrup I take a closer look at what kind of students the biotech class is meant for at different points in the development of the programme and what that might tell us about the concept of talent in a Danish context. To do this I utilise a tool for analysis called the implied student.

Part I

LITERATURE REVIEW

2 INTRODUCTION

Research in the field of giftedness is broad and holds multiple views of what defines and what leads to giftedness. When working with giftedness a need for a discussion of the many perspectives on the matter arises. It is because of this I have chosen to make this review. When trying to describe talent activities it is necessary to have at least some knowledge about what the organisers actually think of when they say talent.

This section will give a brief introduction to the concept of giftedness and what aspects of it are covered in this review. The aims of this review will then be presented and explained before I give a description of how it is structured.

2.1 THE TOPIC OF THIS REVIEW

Giftedness is a difficult thing to define. It will later be discussed how difficult it actually is, but for now it will be sufficient to state that it is a concept related to how good people are or can be at something and that for this master thesis that *something* is science and closely related topics.

Giftedness has been the subject of studies for just over a century, but has been an aspect of how we think of human potential and ability for much longer. This review will give a description of how the research field of giftedness was created and how it developed into the field we have today. It will also describe what we actually think of when we talk about giftedness or rather what some people think of and what others don't. A third topic will be how giftedness relates to education. What research has been done in Denmark will be the last topic to be covered before I end the review by relating it all to the remaining parts of the thesis.

Of course this doesn't cover all there is to giftedness. There are plenty more interesting aspects of the field and not even all details of each topic can be covered here. The development of talents of course doesn't stop at the end of education. It is a lifelong journey but the foundation can be laid at a very early age. I have chosen to put my focus on what happens in the years up to and thorugh the Danish upper secondary school - the gymnasium. This is a short period of a full lifetime, but it is extremely central for those continuing in the fields of science because it is here they choose their direction (Holmegaard et al., 2014).

2.2 THE AIMS OF THIS REVIEW

Context is important. This review has multiple aims, but they all relate to describing the context for this thesis in some way.

One aim is to simply give a description of the field. However since the description becomes somewhat contradictory with the many different views of giftedness it becomes necessary to also discuss opposing views of giftedness.

Another aim is to organise the models of giftedness and compare their similarities and differences for the purpose of synthesising a combined view of how giftedness can be determined in relation to programmes for gifted students, which can then be further elaborated and expanded in the later description of programmes for gifted students in Denmark.

This leads to a third aim, which will be to critically review the current efforts in gifted education and the programmes for gifted students and to show that a need for further research on how to work with gifted children exists.

When combined, the fulfilment of these aims serves as a motivator for the remaining parts of this thesis.

2.3 THE STRUCTURE OF THIS REVIEW

After this introductory section I will present some historical background for the field of giftedness research. Following that section a series of models for giftedness will be presented and compared. After that an overview of gifted education and aspects thereof will be followed by an overview of recent Danish research topics in the field of giftedness and a discussion of issues which need to be covered. As a conclusion it will be discussed how this master thesis is situated in current giftedness research.

Each of these sections contains a series of subsections all of which are in fact areas of research that often work independently of the other areas in the section. By placing the discussion of these in the same sections I will make the connections clearer and at the end of each section these connections will be elaborated upon.

3 ORIGINS OF GIFTED EDUCATION

In the late 19th century when Charles Darwin had just published his theory on the origins of species his half-cousin Sir Francis Galton initiated the field of giftedness research. In the beginning of the 20th century Alfred Binet and Théodore Simon laid the foundation for the tests that we today know as the IQ-tests. Their work was later expanded by many other researchers. One version of it, the Stanford-Binet test, was used by Lewis Terman in his longitudinal study of gifted people. At the same time Leta Stetter Hollingworth was studying the connections between giftedness and school which led to the formation of the field of gifted education.

This chapter will take a closer look at these events in the early development of gifted education. These events made the foundation of giftedness research and as such it is interesting to see how they came to be and what they have meant for the progression of the field.

3.1 GALTON'S GENIUSES

Hereditary genius: An inquiry into its laws and consequences is the title of a book written by Sir Francis Galton in 1869. The work that lies behind this book is often considered the first scientific study of giftedness (Ericsson et al., 1993; Gagné, 1998b; Stoeger, 2009). In it Galton claims that what he calls "eminence", being exceptional performance, must be transmitted from parents to their offspring and that it is an inherited natural ability. Galton, inspired by his half-cousin Charles Darwin's discovery of evolution, was convinced that intelligence was passed on through generations. He came to this conclusion by studying biographical sources of the most notable families in England, how they were related and what they had done.

Galton, however, was of course not the first to notice that not all people were equally gifted and that there were extreme outliers. Plato and Confucius both spoke of "heavenly children" and Paracelsus used the term "talent" in 1537 (Stoeger, 2009). Galton, following the trend of his time, started to look at family trees for eminent people and measure the distance between the eminent individuals. As a result of this he found, that eminent people had a higher probability of being closely related to other eminent people than distantly related (Ericsson et al., 1993). To determine whether people were eminent he decided to set the cut-off at the top 0.025 % of the British population at that time (Gagné, 1998b). This of course sounds like a very small group of people and much less than some present day estimates of

giftedness or talent, but we probably need to consider the huge disparity in the British society at that time which had an immense effect on who could develop and show their eminence in a given domain.

Whether eminence really is a hereditary trait has been a big question ever since and is something I will discuss in the next chapter when dealing with the expert approach.

3.2 MEASURING THE INTELLECT

1 in 4000 is not a lot. Especially not when you are looking at people and are trying to find the top 0.025 % of them based on a fluffy concept such as eminence. It is not self-evident who these people are and there is no sharp discontinuity in eminence at this exact partition of the population. Probably in realisation of this Galton developed a battery of measures which were tested in 1884 (Boake, 2002).

Measures of intelligence can of course not only be used to find those with the highest intelligence. It can also be used to find those with the lowest and that is in fact the reason why many other early intelligence scales, including the IQ scale, were developed. In 1900's Paris it was decided that admittance to "special education" should be made "on the basis of medical and scholastic certification" (Stoeger, 2009). To decide who could be admitted Alfred Binet and Theodore Simon developed a series of tests for children aged 3 through 15. This scale came to be known as the Binet-Simon scale. It was used to differentiate normal and cognitively impaired children and could also show an increase in cognitive ability with age (Boake, 2002). In a 1908 revision, Binet and Simon changed the format of the scale by grouping the tests in age groups so that the test could determine an "intelligence age" of the child, which could be held against the child's chronological age. In this form the scale has later been criticised for overemphasising verbal aspects in its testing and for the whole concept of an intelligence age.

William Stern was one of the critics of the revised Binet-Simon scale and pointed out the problems with an age dependent significance of difference between intelligence age and chronological age (Stoeger, 2009), i.e. a 2 year difference for a 12 year old is much less significant than a 2 year difference for a 4 year old. To make up for this significance he suggested using the quotient of intelligence age and chronological age multiplied by 100 as a measure for intelligence. This gave the first version of the famous Intelligence Quotient (IQ) scale.

This scale assumes a linear growth in intelligence with age in the way it is designed. This I dare say is evidently not the case and so thought David Wechsler, an American psychologist. Wechsler decided to give up on the concept of intelligence age and instead decided to use the average test scores for each age group as the measure for a scale score of 100. For this scale Wechsler decided a score of 15

points should constitute a standard deviation. The scale was dubbed the Wechsler-Bellevue scale and is to this day the foundation of modern IQ tests. The abbreviation has been kept even though the scale no longer has any relation to quotients. A shift to the standard deviation measurements rather than quotients was a necessity for Wechsler, since he was primarily working with adult psychiatric patients and the previous tests only worked on children (Boake, 2002). Another important aspect of the Wechsler-Bellevue scale was that it combined verbal and performance tests into one test to measure a more general intelligence than previous scales. Boake (2002) cites Wechsler for writing in his 1939 book "The measurement of adult intelligence" that the scale was "constructed on the hypothesis that an individual manifests intelligence by his ability to do things, as well as by the way he can talk about them" (Wechsler, 1939, p. 138). In other words Wechsler saw intelligence both as an ability to perform tasks and to explain things, whereas previous tests had used only one of the two.

The Wechsler-Bellevue scale has undergone a lot of revisions since its conception but the basics of it are unchanged. It still has a mean value of 100 and uses a standard deviation of 15 points. The first revised version, the Wechsler Mental Ability Scale, was used during World War II for screening recruits in the American military (Boake, 2002). This scale was later published as Form II of the Wechsler-Bellevue scale and used as a basis for future revisions. In 1949 a version for measuring children aged 5-15, the Wechsler Intelligence Scale for Children (WISC), was published. The sample for creating its baseline tested children of both sexes, from different geographical regions in the US and with parents from different occupations. All children, however, were white. The most recent revision of the WISC, the WISC IV, includes race/ethnicity in its sampling and uses 11 age groups between ages 6 years and up untill 16 years and 11 months (Wechsler, 2003). Similar versions have been developed for adults.

For Terman's *Genetic studies of geniuses*, which will be covered in the next section, a modified version of the Binet-Simon scale was used. Inspired by Stern's suggestions of using quotients, Terman devised an intelligence scale dubbed the original Stanford-Binet scale (Boake, 2002). This scale quickly became the dominant tool for measuring intelligence in the US and remained so until the Wechsler-Bellevue scale took over at some point in the 1940's.

3.3 THE TERMITES

In 1921 Lewis Terman started a study originally named the Genetic studies of geniuses, later renamed the Terman study of the gifted. To this day it is still running and probably will remain so, at least until the last subject dies. The study has been following more than 1000 individuals who scored 135 or above on the Stanford-Binet scale

which was specifically devised for this study (Gagné, 1998b). This IQ threshold puts the subjects in the top 1 % of the population. The sample from which they were chosen consisted of approximately 250,000 schoolchildren all from California. The selected children were thoroughly described and examined at the onset of the study and then followed up on every 5 or 10 years until now (or when deceased) (Goleman, 1995; Stoeger, 2009). White middle-class children were heavily overrepresented in the study compared to the general Californian population (Cravens, 1992). The subjects are today often called the "Termites".

The study, according to Terman himself, had a twofold purpose. The first purpose was to find what traits characterise children of high IQ and the second to "see what kind of adults they might become" (Terman, 1954, p. 223).

As part of the original study Cox (1926) conducted a retrospective study of 300 "historical geniuses" in much the same way as Francis Galton had done (Terman, 1954; Cravens, 1992). This study gained much less focus than the longitudinal study. Terman sums up the conclusion of it in the following way: "the genius who achieves highest eminence is one whom intelligence tests would have identified as gifted in childhood" (Terman, 1954, p. 225).

Based on his longitudinal study Terman concluded that "children of IQ 140 or higher are, in general, appreciably superior to unselected children in physique, health, and social adjustment; markedly superior in moral attitudes as measured either by character tests or by trait ratings; and vastly superior in their mastery of school subjects [...]. Moreover, his ability in the different school subjects is so general as to refute completely the traditional belief that gifted children are usually one-sided" (Terman, 1954, p. 223). The extensive data collection over more than 90 years, in the form of surveys on anything from social background and vital statistics to career choices and literary interests (Stoeger, 2009), has resulted in several articles on many other topics than giftedness, such as mortality, marriage stability and gender (cf. Friedman et al., 1995; Holahan, 1994).

There is no doubt that the publications associated to Terman's study of the gifted is extremely numerous. There are, however, more than a few critics of both the methods and results of the study. Wechsler stated that it was the shortcomings of the Stanford-Binet scale, used to seek out the termites, which convinced him of the need for a scale less focused on verbal skills acquired through formal education (Boake, 2002). The selection of participants have also been criticised based on the socio-economic and ethnic composition of the final group (Borland, 2004). Cravens (1992) notes that Terman might have been limited by his view that IQ was a fixed characteristic of a person and that the study as a result only looked at norms or averages of the group and never tracked individuals. Howe (1982) focuses in

his critique on the fact that the subjects end up being pretty much ordinary for their socio-economic background. When seen as a study of giftedness it is also worth remarking that the study equals IQ with giftedness. This will be elaborated upon in the next chapter.

Several other kinds of critique have been raised against the Terman study of the gifted. Nonetheless the study has had and still has a big influence on the field of giftedness because of its size and the questions it has raised.

3.4 CONNECTING GIFTEDNESS TO EDUCATION

As the title of Terman's genetic study of geniuses implies he put a lot of weight on the heredity of giftedness much like Galton before him. One of Terman's contemporaries, however, had a different view. Leta Stetter Hollingworth is today known as the person who connected giftedness research to education. Whereas Terman and Galton assumed that a person's eminence would manifest all by itself, Hollingworth claimed that environment probably also had some effect (Silverman, 1989).

In 1918-1919 Hollingworth taught the first course ever to be offered on the education of gifted students (Silverman, 1989; Stanley, 1990). Two years earlier she had taught a course on the psychology of mentally deficient children, where for the sake of contrast she had invited a gifted student to be tested during a lecture. This sparked her interest in giftedness and led her to focus all of her efforts on the subject until her death 23 years later.

From 1922 to 1925 she led a longitudinal study of the students at a public school. The study measured a long list of things from motor coordination and neuromuscular capacity to personality development and interpersonal relationships (Klein, 2000). The 50 students in the study consisted of two classes with median IQs 165 and 146 (Stanford-Binet). The classes were made as an experiment and their objective was stated as being twofold. Firstly the children were to learn as much as possible. Secondly they were to be measured as much as possible, because so little was known about their needs (Klein, 2000). This led to a very special form of teaching for the time. It was very focused on accelerating the learning process and what we today might call differentiated teaching. Hollingworth wrote a textbook on the findings from her school called *Gifted Children, Their Nature and Nurture*, which today is recognised as the first textbook on gifted education.

Hollingworth wanted to continue her work at the school but was unable to find the funding for it, and the programme was shut down in 1925. In 1934, however, Hollingworth was asked to start a public school to study exceptional children - gifted and cognitively disabled (Klein, 2000). In 1936 the Speyer School enrolled its first 225 students,

50 of which were placed in two gifted classes with a median IQ of 145 (Stanford-Binet). The remaining 175 students who scored between 75 and 90 on the Stanford-Binet scale were placed in other classes, and were also the center of a lot of research (cf. Gates and Pritchard, 1942; Pritchard et al., 1940). Hollingworth had made sure that the gifted group was a diverse group of 23 different national backgrounds and from all over New York. The school work at Speyer School stood out from many other schools at the time. The pupils had several field trips, the teaching was adapted to the level of the individual student and a lot of the work was project based. Outside the classroom the students could take part in extracurricular activities where they would be mixed with all the other students.

Based on the work done at Speyer School in the late 1930's and her experiences from PS 165 Hollingworth argued that children above 140 IQ waste half of their time in school and children above 170 IQ waste practically all their time (Klein, 2000). She advised the remaining time should be spent on enrichment and acceleration. Hollingworth was very enthusiastic about providing the pupils with knowledge of what she called the evolution of culture. Focusing on how the pupils could "take their unique places in civilized society" I think this concept in a Danish perspective today would be translated into what is called "dannelse" or in international lingo "bildung".

Hollingworth's work marks a significant new direction in the study of giftedness for her time. In her work giftedness is no longer assumed to be like the genetic makeup of the ugly duckling which forces it to develop into a beautiful swan. It has to be nurtured. A child can also be gifted even though it doesn't show immediately. Hollingworth was one of the first to propose the possibility of a coexistence of giftedness and a handicapping environment (Silverman, 1989). In the gifted classes at the public school and Speyer School she studied whether enrichment, acceleration or a combination thereof was the best solution for the pupils and whether the class should have a homogenous or heterogeneous composition in regards to IQ. Furthermore, she was also active in the gender equality movement of the time and did some research into gender aspects of giftedness (cf. Hollingworth, 1914).

As mentioned earlier Hollingworth is widely regarded as the founder of gifted education (Klein, 2000; Silverman, 1989; Stoeger, 2009). The works at PS 165 and Speyer School led to studies focusing on the role of special schools, special classes in regular schools, giftedness programmes and acceleration/enrichment (Stoeger, 2009). A later chapter of this review will focus on specific topics in gifted education such as differentiated teaching, acceleration and giftedness programmes.

This chapter has traced the development of giftedness research until the 1940's. After this period it had a new revival in the 1960's in the US as a consequence of the famous Sputnik moment. In general,

political and societal trends have been the most important drives for research in giftedness. With all the talk about globalisation and the need for innovation, research on giftedness is revived.

4

MODELS OF GIFTEDNESS

There are those students who are obviously gifted and there are those who are obviously not. But how do we define giftedness and where do we draw the line between gifted and not-gifted? Not only are there many ways of defining a gifted person there are also many different words for similar and overlapping groups of people. So how do we define people who are eminent, talented, gifted, geniuses or experts? George (1997) have found that there are more than 200 answers to this question. This chapter will present some of the definitions of these groups and explore a few of the tendencies they follow.

4.1 INTELLIGENCE PROBLEMS

"Intelligence is the best-documented predictor of achievement. Reliable and valid measures of IQ have made it possible to document a wide range of achievement outcomes affected by IQ" (Duckworth et al., 2007, p. 1088). Since Terman's study of the gifted, IQ measurements have been used for selecting participants to longitudinal studies of giftedness. As described in the previous section, there has been much discussion on what kind of tests should be performed to measure the intelligence. IQ of course is not a standardised unit. It is merely a measure of how well a person does on a specific series of tests compared to everyone else who has taken it. We do not assume that tests like the PISA or TIMSS are giving a picture of the general intelligence level of a population because they test knowledge and competencies. IQ tests are different from these tests in the nature of their content. They test a general intelligence; one that is often assumed impossible to learn. This idea has been increasingly challenged by models of multiple intelligences, which will be discussed towards the end of this chapter (cf. Gardner and Hatch, 1989; Davidson, 2009).

According to a study from 1984 the average IQ of North Americans has increased 13.8 IQ points from 1932 to 1978 (Flynn, 1984). According to the same study the North American Scholastic Aptitude Test - Verbal (SAT-V) scores have decreased over the same period (the SAT-V is the test most significant as a predictor of college grades). No matter what the reason for this increase in tested IQ level is, it leaves us in a position where we need to reconsider the weight we put on these tests when seeking out gifted students.

The increase in IQ test scores was found by statistical comparisons between studies which have used the different IQ tests from 1932 to

1978. Flynn suggested that the higher IQ levels could be caused by "increased test sophistication and a rising level of educational achievement" (Flynn, 1984, p. 47) as a result of the increased socioeconomic status of the general population, but as he noted this should also show up on the SAT-V then.

Terman's view of giftedness was equated to a high IQ score (Cravens, 1992). Since the 1980's there has been not just a change of view but also a multitude of new ways to look at giftedness. A common factor for most of the definitions of giftedness is to exclude IQ as a criterion. They don't necessarily reject its influence they just use other methods to differentiate between the gifted and the normal. In this way giftedness has advanced beyond IQ in its methods of measurement. At the other end of the scale, however, little has changed. Boake remarks in a 2002 paper that: "The intelligence scale that is relied upon to make medical, educational, and legal decisions does not reflect advances in understanding of cognitive functioning during the past 60 years and contains tests from the 1800s" (Boake, 2002, p. 201).

In the following sections some of the new ways to look at giftedness will be discussed.

4.2 BEYOND IQ: INTELLIGENCE & GIFTEDNESS

As mentioned earlier George (1997) found that there are more than 200 interpretations of what giftedness is. These have of course been found in studies published over a long time span, showing that the interpretation of the concept may very well be time dependent. This has been supported by other studies (Moltzen, 2009). In fact not only does the interpretation of giftedness depend on time it also depends on place i.e. the culture of the interpreting group.

Terman had a very simple definition of giftedness (Moltzen, 2009). He simply equated it with a high score on the Stanford-Binet scale. If you scored above 130 you were considered gifted. This definition of course only passes the problem on to the question of what the Stanford-Binet scale measures. The Stanford-Binet scale measures the intelligence age and relates it to the chronological age of the test subject. What defines intelligence is a question which few can agree on a single answer to. Sternberg and Berg (1986) pointed out three different ways of looking at intelligence: a psychometric perspective, a signal processing perspective and a context focused perspective Stoeger (2009). Theories with a psychometric perspective often look at subcategories of intelligence. An example is the theory of fluid and crystallized intelligence (Horn and Cattell, 1966) which distinguishes between fluid intelligence characterised by thought and mental processes and crystallized intelligence characterised by the ability to use knowledge and memories. The signal processing perspective focuses on how the brain processes data. It is probably the most physical

notion of intelligence there is and can in some ways be compared to the computer scientist's view of a computer. Central concepts are working memory capacity, quickness and efficiency. Finally there is the context focused perspective where intelligence is something that emerges out of a dynamic collaboration between the person and the environment.

In many studies and talent programmes the selection of gifted students is done by a teacher or based on applications (cf. Wirt, 2011; Stake and Mares, 2005). Here the selection process is not based on IQ measurements but on grades, activity level, motivation and many other factors. Terman (1925) also asked the Californian teachers to point out the students they thought might have a high enough intelligence to be in his study. With a selection process such as this we might start to consider the relationship between characteristics of the target group and how we define them. That is, what are the defining characteristics of the group and what other characteristics might they share (that other people may also have). This will be further elaborated in Section 5.5. Galton as previously mentioned found eminence to be a matter of heredity. He did, however, acknowledge that "zeal" and "a great deal of very laborious work" had a role to play in becoming a genius (Hambrick et al., 2014). Since the early 1990's the role of laborious work has played an increased role in giftedness research. 21 years ago, Ericsson et al. (1993) published a study on the role of something they called deliberate practice in the development of expertise. In doing so they went from looking at a high level of cognitive abilities e.g. intelligence as the deciding factor for becoming great at something to instead looking at the number of hours spent on becoming great. Personality, in particular how motivated and perseverant a person is, suddenly became much more important than intelligence. This view will be discussed further in the next section.

In some of the later models for the development of gifted children like the Differentiated Model of Giftedness and Talent 2.0 (Gagné, 2010) and the Munich model of giftedness (Heller, 2005) the personality of the gifted child plays a central role along with the environment. Models like these shows a growing consensus that giftedness alone is not enough to become an expert/genius.

4.3 THE EXPERT APPROACH

You may be born with an immense IQ or with a great potential for becoming one of the best in a field, but that doesn't mean you will become the best or brightest within that field. It takes practice; a lot of practice. This was pointed out by Ericsson et al. (1993). They found that expert musicians when compared to amateurs and teachers significantly outperformed them in time spent on practicing. Expert pianists would reach more than 10,000 hours of practice at the age of

20 while an amateur might reach 2,000 hours at the same age. The type of practice wasn't irrelevant either. In their study Ericsson et al. focus on something they called deliberate practice, a kind of practice that challenge you and actually might do so in a way that makes you tired. One of the things that made the experts stand out from the rest of their colleagues was the fact that they napped. Their morning practice was so intense and challenging that they actually had to take a nap at about 3 in the afternoon. How much of this can be transferred from the field of music to other fields has been the centre of some research since then (cf. Duckworth et al., 2007; Hambrick et al., 2014).

A lot of practice takes a lot of time. Gladwell (2008) along with others have popularised a myth stating that it takes at least 10,000 hours, equating to approximately 10 years, to become an expert within a given field. This is not true. An example of this is given in Hambrick et al. (2014). Here it is shown that the mean amount of deliberate practice to become a chess master is 10,530 hours but that the standard deviation for the 90 players in the study was 7,414 hours and the total range was 832 hours to 24,284 hours. In other words it may take you as little as 832 hours of deliberate practice to become chess master or it may take you a lot longer.

To put in the required number of hours, no matter what that number may be, takes some motivation. Motivation when related to developing an expertise is sometimes called grit. Duckworth et al. (2007) defines grit as perseverance and passion for long-term goals (p. 1087). The results of a person's laborious efforts may not materialise immediately and so where some people might lose interest in the field and seek other challenges the gritty person will continue. Duckworth et al. (2007) found that grit correlated positively with success in as different situations as military academy training, spelling bees and Ivy League education. What's also interesting is that they did not find IQ to be correlated positively to grit. They did, however, admit a more heterogeneous sample was needed to make any conclusions regarding the correlation (or lack thereof) between IQ and grit.Yet the results do suggest that grit is an essential ingredient to high accomplishment and that we may need to take it into consideration for talent programmes.

As described earlier some of the newer multidimensional models of giftedness include motivation and other personality factors in their description of what it takes to develop a certain talent. Whereas older models or definitions use IQ as a general prerequisite for almost any exceptional performance some newer models see the gifted as less of a polymath and more of a specialist. In Gagné's Differentiated Model of Giftedness and Talent (DMGT) giftedness is sorted into a multitude of domains, one of which is intelligence, and talent in fields, which are performance specific (Gagné, 1985, 2010).

The expert approach to giftedness has strengthened the focus on the process it is to go from potential to realised talent and changed the view of the gifted to not just include cognition in the form of intelligence but to also include personality. Gagné (2010) emphasises the role of the process by making it the distinguishing factor between talented and gifted.

4.4 MULTIDIMENSIONAL MODELS

In science the principle of Occam's razor is held high. The principle basically states that the theory/model with the fewest assumptions should be used in favour of more complex theories/models (Godfrey-Smith, 2009). The idea of a general intelligence is a very simple one. It is so simple that to use a high general intelligence as definition of giftedness would make it a one-dimensional model since it claims to be able to position every test subject along a (one-dimensional) line. As the previous sections have shown more recent research in the field of giftedness imply that general intelligence in the form of IQ is not a sufficient factor in describing what may constitute giftedness. This has led to the multitude of new definitions of giftedness George (1997) reports of. Many of the new definitions still hold on to some concept of intelligence and rightly so, since it has after all been proven to have a predictive value for high achievement (Duckworth et al., 2007). Some new theories propose a multidimensional approach to intelligence (Davidson, 2009). In doing so, they move away from the domain-general approach of general intelligence to a domain-specific intelligence. An example of a multidimensional approach to intelligence is Gardner's multiple intelligence theory (MI theory), which proposes a whole series of intelligences rather than just one general (Gardner and Hatch, 1989). These intelligences may have some correlation and are often expressed in an interactive manner. Gardner defines intelligence to be "a biopsychological potential to design culturally valued products and solutions" (Davidson, 2009, p. 83). Examples of intelligences from MI theory are logical-mathematical, linguistic, spatial, bodily-kinesthetic and interpersonal. The first three are similar to what is measured in traditional IQ tests. The other intelligences mentioned are some that are usually not tested for in IQ tests, but are valued in many cultures. Later in this section it will be described how MI theory has affected multidimensional models, using the Differentiated Model of Giftedness and Talent (DMGT) as an example. MI theory is not the only one to take a multidimensional approach to intelligence. Sternberg (1985) proposed what he called the Triarchic Theory of Successful Intelligence in which intelligence is divided into analytical, practical and creative aspects. This approach keeps the domain-generality of the intelligences and distinguishes instead between the underlying mental processes. Unlike MI

theory, several studies have been conducted to validate this model by using it to match teaching levels with gifted students across cultures (Sternberg et al., 2001; Sternberg, 2003).

Deliberate practice and the related concept grit have previously been presented as new components to giftedness models. Other components are societal aspects, gender and environment (Davidson, 2009). Societal aspects in models of giftedness often reflect culturally based values. In New Zealand for example Maori culture has "an inherent expectation that a person's gifts and talents will be used to benefit others" (Bevan-Brown, 2004, p. 179). A maori model of giftedness might thus evaluate giftedness based on a measurement of practical benefit. Gender is a huge field in education and plays a growing role in giftedness research as well. Silverman (1995) has raised the question of whether most conceptions of giftedness are in fact based on a masculine view. Davidson (2009) makes the counter argument that the barriers are in fact based in the construct of our world and not the models themselves, but agrees that modifying our models to accommodate gender issues might result in a change in culture. Environment and person actions and interactions are another often central component in models of giftedness. Some see the person as acting on the environment and in a way shaping it or themselves to create the best fit (cf. Sternberg, 2005). Others see the environment as imposing restrictions or possibilities on the person and thus guiding the person in a certain direction (cf. Gagné, 2010). Finally there are those who see the process of developing a gift as a constant interaction with the environment (cf. Ziegler, 2005).

What is gained by adding dimensions to our conception of giftedness depends on which model we look at. In general the models have been build on the strengths and shortcomings of former models and as such are intended to give a more nuanced image of who the gifted are and what can be done to help them develop their gifts. Whereas early models focused singlehandedly on identifying the gifted and gave no suggestions as to what should be done to nurture their gifts some newer models incorporate the developmental process of the gifted in their models (cf. Gagné, 2010; Ziegler, 2005; Heller, 2005). This indicates that giftedness is not just a state, it is also part of a process. How this process should be shaped and what role the gifted might play in it, is to a large extent the content of giftedness education which will be the subject of the next chapter.

5 GIFTED EDUCATION

Hollingworth's work with gifted students at her public school and Speyer School has earlier been presented as the onset of gifted education. This chapter will take a closer look at the educational aspects of giftedness and touch on some specific methods of dealing with gifted students and how they are perceived in the school.

5.1 UNDERACHIEVING GIFTED STUDENTS

What defines a gifted student has previously been discussed, yet the only conclusion that can be drawn is that there is no consensus. Some definitions point to intelligence measurements others to high levels of motivation and competence. Many of the definitions use potential as a central concept describing how well a student can do if his or her gift is properly nurtured and developed. When a gifted student is not able to achieve what is perceived as his or her potential the student is labelled underachieving. As with giftedness a definition of underachieving gifted (UAG) students agreeable to all is hard to come by. In general, a discrepancy between perceived potential in the form of intelligence and actual performance, where actual performance is the lesser, is considered the central part of the definition. How the discrepancy is to be defined is where most disagreements break out. Dowdall and Colangelo (1982) reported on several different definitions and gave an example where 5 definitions would say a person was an UAG student, 3 would say the person wasn't and 7 wouldn't be able to give an answer even though all relevant test scores were given.

The concept of UAG students assumes a definition of giftedness that is not based on high performance in school but rather on intelligence. As such quite a large portion of the giftedness research field will not acknowledge it as a relevant question for giftedness research but rather one for education in general. An example of such is Renzulli (1978) who defines giftedness to be in the intersection between task commitment, above average ability and creativity. UAG students are by this definition not considered gifted because of their lack of task commitment.

Regardless of whether this group of students should be considered gifted or not they do exist and is an interesting case since they may be considered to represent a group of gifted students who do not fit into the educational settings they are placed in.

There are probably several causes for gifted students to end up being considered underachievers. Some suggested reasons are family interactions and attitude towards education (cf. Thiel and Thiel, 1977) and a fear of becoming a social outsider (cf. Baker et al., 1998). Gender in relation to UAG is also a hot topic. Fennema et al. (1990) showed that boys were more likely to be considered underachievers while girls' high ability was considered a result of hard work by their math teachers.

If one accepts the existence of UAG students the important question becomes whether or not the students can become high achieving. Dowdall and Colangelo (1982) refer to two kinds of intervention methods against UAG. One focuses on counselling addressing the low self-esteem of the students while the other focuses on the classroom environment. Neither of these was very successful but results suggest that if we are to expect a positive effect then the effort should start early and be long-term.

5.2 SPECIAL NEEDS TEACHING

In the late 19th century when Galton was writing his book *Hereditary Genius* a general assumption about giftedness was that it had to be counterbalanced (Stoeger, 2009). The divergence theory as it was called prescribed that giftedness was correlated with negative physical and psychological traits as well as emotional imbalance. Today the divergence theory is not considered accurate, but it still tells us something important about the general view of gifted children. Not all gifted children are prodigies who excel at everything. Some may be brilliant in their analytical skills but at the same time dyslexic. Hughes and Dawson (1995) found this to make them too bright for the slowest groups and unable to cope with the written work of the top groups. There are many ways in which otherwise gifted children may be impaired, dyslexia being just one of them. In some cases the nature of simply being gifted can result in impairment due to bullying or social distance to classmates (Montgomery, 2006). Impairments like these may lead to underachieving and often call for special needs teaching.

Montgomery (2006) suggests that we see this group of gifted children as having different patterns of difficulties. This effectively means that the teacher has to focus on different kinds of problems than with most other students. In many cases the student's problems will be more based on the form of the tasks than on actual content. Not all problems can however be solved in the classroom. In some cases special needs teaching of some sort is the necessary solution for a gifted child.

Special needs teaching is incorrectly considered to be something for the generally less able children. However special needs teaching

is for children with specific needs and as such these children may very well be gifted in other contexts. Therefore it is important not to reject the possibility of a child being gifted simply because he or she is enrolled in a special needs program. The extra instruction may very well be the thing that enables the child to develop his or her gifts in another domain.

So what can be done for the gifted children? So far most of what has been described in this chapter has been about what shouldn't be done and who shouldn't be left out. The following sections will look at what can be done for the gifted. Montgomery (2006) advocates for the availability of seven types of gifted education provision in every school. These types are differentiated teaching, grouping of students, clubs and societies, mentoring, extension and enrichment, acceleration and distance learning. Some of these will be covered over the next few sections.

5.3 DIFFERENTIATED TEACHING

Students learn at different paces. Some might quickly pick up the central aspects of a topic while others might take quite some time. To avoid leaving students behind or having others wait for the rest to keep up some sort of differentiation in the teaching seems to be needed. This can be done in many ways. In some cases the students are grouped according to how quickly the teacher expects them to learn and are then given different kinds of tasks. In other cases students are given extra tasks when they reach an understanding of the topic. These are just some of the ways in which the teaching of a topic can be differentiated between the students.

Inclusion of all children in education has been the dominating topic on UNESCO's educational agenda since 1989 (Smith, 2006; UNESCO, 2004). This kind of inclusion, however, has not focused on ensuring the teaching include all the students in the class. Instead it has focused on how to make room for students currently not in the regular classes in the schools. More specifically it has focused on marginalised students with learning disabilities. Smith (2006) makes the argument that this has happened at the expense of the able learners who may now find themselves waiting for the rest to keep up.

The efforts to make an inclusive environment in the classrooms vary between countries. In Denmark and the other Scandinavian countries the schools are required to "challenge all students" (Folkeskoleloven §18 stk. 2; Opplæringslova §1-1; Skollag kap. 3 §3). Students can be challenged in many ways. The seven types of provisions for gifted education (Montgomery, 2006) give us a list of possible methods. The "goto" method in Scandinavia is inclusion, in the form of in-class differentiated teaching, and to some extent grouping of the students (Rasmussen, 2010a). Rasmussen argues for the use of this method

based on the inherent heterogeneity of the Danish unity school (enhedsskolen). Rasmussen compares the unity school with a system involving multiple kinds of elementary schooling such as the German and French. Both do a bad job with the less able; however, the split system does a better job with the able students. The German and French solution to dealing with the able and less able is to let them skip grades or stay an extra year. This is almost never done in the Danish system where extra classes, in the form of special needs teaching, for the less able students seem to be the solution. For the able students in the Danish unity school enrichment programmes, clubs and societies seems to be the favoured solution as i Will show later. These kinds of provisions for gifted education along with acceleration will be the topics for the remainder of this chapter.

5.4 ACCELERATION AND GRADE SKIPPING

A general trait for all schools is that they are organised in years. This makes the system seem quite rigid if a student is significantly more advanced than the rest of the class. In the course of a year the students are supposed to learn a lot of things and ideally each year will build upon knowledge from the previous ones. A year-based school naturally assumes that all students learn at approximately the same pace. At least it appears that way. Differentiated teaching, where the able students are asked to go deeper in their understanding, may be able to make up for the difference in learning pace among the students. Another solution is to accelerate the able students by letting them pass through the system quicker. Here the rigidity of the year based school turns into a problem, because how are they supposed to get one year ahead without receiving the instruction? The social implications of being moved to a more advanced class are also worth noting.

In Denmark it is very rare to be moved up or down by a year. In Germany, France and Belgium, however, it is quite common to be moved down one year (35 % of the students in Germany and approximately 50 % in France and Belgium will at some point be moved down one year (Rasmussen, 2010a)).

A series of studies have looked at gifted children's friendship with other children (cf. Gross, 2006b; Janos et al., 1985; Sheldon, 1959). It seems that highly gifted children tend to have very few friends and often see themselves as being socially isolated from their classmates due to a gap in mental age. Often the highly gifted children will find friends among older students or even adults because they find them to be more similar in interest and humour. This of course talks to the advantage of accelerating the students but other studies such as Freeman (2006) have found opposing social views.

Two large studies (Gross, 2006b; Lubinski et al., 2001) have followed exceptionally gifted children (IQ 160+) and looked at how much they were accelerated during their education and how they felt about it. Both studies found that the children in general gained from being accelerated both socially and academically. Gross (2006b) comments that "possibly the greatest gift we can give to a gifted child is a teacher, who recognizes the gift, who is not threatened by it, but rather rejoices in it and works with joy to foster it" (Gross, 2006b, p. 418). It is important for the child to have a teacher of this kind to follow him or her through the acceleration and to support and guide the child in the difficulties that may arise. Several of the children who were not accelerated in Gross's study had social problems and difficulties staying in unchallenging educational systems. In relation to the teacher aspect of acceleration Southern et al. (1989) found a reluctance to employ acceleration and early entrance among many teachers and principals. These were able to base their reluctance on research opposing acceleration but unable to mention any of the more recent research in favour of acceleration.

Lubinski et al. (2001) followed American children while Gross (2006b) followed Australian children. The educational systems of these countries are of course different from other countries'. In a third study conducted in the UK Freeman (2006) found that out of the 17 students she had followed who had been accelerated 16 would not allow for their own children to be accelerated. This may imply that the educational system or culture has an influence on the usefulness of acceleration.

5.5 EXTRACURRICULAR ACTIVITIES FOR THE GIFTED AND TALENTED

So far the provisions for gifted education covered here have focused on class structure and content but a lot of the provisions suggested by Montgomery (2006) actually take place outside of the classroom. Probably the most notable extracurricular activities when it comes to gifted science students are the science Olympiads, fairs, expos and camps. Since these activities are optional for the students a lot of the studies on such activities focus not on what the students learn but what changes in motivation, confidence or passion might result from participating (cf. Stake and Mares, 2005; Oliver and Venville, 2011).

The aims of many of these activities are not purely educational. For example, the International Physics Olympiad (IPhO) has as its aim "to enhance the development of international contacts in the field of school education in physics" (IPhO, 2013) and the European Union Contest for Young Scientists (EUCYS) "was set up to promote the ideals of co-operation and interchange between young scientists" (EUCYS, 2014). This agrees with the research in the field, the focus of

which is not what the students learn but on the students' change in attitude towards science.

Most studies are positive regarding the effects of participation in extracurricular activities in science. Oliver and Venville (2011) reported that the participants in the Australian Science Olympiad already had positive attitudes towards science when they started but that it was enhanced by the experience of science in a less rigid setting than at their school. Wirt (2011) reported how participation in the American Science Olympiad had an impact on career choices of participants and increased the level of learning and interest in STEM areas. Both Oliver and Venville (2011) and Wirt (2011) reference Abernathy and Vineyard (2001) who called for more research on the impact of extracurricular competitions on motivation and goals. Abernathy and Vineyard acknowledged studies that found students to suffer in competitive climates and lose motivation, but emphasised that they only looked at classroom behaviour. Stake and Mares (2005) looked at participants in science summer schools for gifted students lasting 6 weeks. They acknowledged that some gifted students when grouped with other gifted students experienced a loss of motivation and confidence, but this loss was outweighed by an increase experienced when they returned to their regular class after the summer school, resulting in a net increase in motivation and confidence. This so-called splashdown effect was stronger in students from academically weaker schools.

Extracurricular activities in science are generally regarded as positive initiatives and rightfully so it seems, but they have some issues. Lengfelder and Heller (2002) found that there generally was an overrepresentation of boys at the science Olympiads. Germany had the lowest number of female participants with 3.4 %. China had 6 % girls, Finland 9 % and USA 10 %. The German gender gap according to Lengfelder and Heller is not based on a gender difference in ability but rather a flawed selection process, where teacher nomination played a too large role. This follows the findings of Fennema et al. (1990) which concluded that high achieving boys are likely to be perceived as gifted whereas girls are likely to be perceived as hard working by their teacher (this was also mentioned in the section on underachievers in this chapter).

6 DANISH PERSPECTIVES

The last chapter took a closer look at what we know about what is actually being done for the gifted students and what the effects are. In this chapter we shall look at it in a Danish context. Denmark has had a few activities for the gifted for a long time but recently there has been a boom in the number and varieties of activities (these will be the topic of part 2 of this thesis). This chapter will take a look at how talent is conceptualised in Denmark, which words are used for the students involved in talent activities and what the framework for the activities is. After this I will describe some of the latest research that has been done on the activities and who is behind this research. Finally some of the unexplored aspects of giftedness in Denmark will be highlighted.

6.1 A DANISH VERSION OF GIFTEDNESS

In the Danish language there are quite a few words which are used to describe the gifted just like there are in international research. The most commonly used in practice is "talent", but terms like "begavet" (literally gifted) and "barn med særlige forudsætninger (BMSF)" (child with special prerequisites) are often used. Like with the international terms the Danish terms have multiple definitions some of which are based on IQ, others on performance and some on a perceived performance potential. The term "begavet" may be preceded with the Danish equivalent of highly or other words indicating a certain IQ range corresponding to the terms used by Gagné (1998b). These terms are primarily used by the organisation Gifted Children and affiliated activities as far as I can tell.

As mentioned in the previous chapter the Danish Folkeskolelov states that the school is required to challenge all students. This is commonly used as the juridical foundation for activities for gifted students. For gymnasium students the "bekendtgørelser" (laws) for all types of secondary education state that the school is required to offer activities for students with special talents ("elever med særlige talenter"). The time for these activities should be taken from a pool of three hours per student at the school (seven for the technical gymnasium), dedicated to students with special needs, special talents or a need for extra evaluation. How this time is distributed among students is decided by the school's principal.

TalentCamp05 was the name of a 48 hour long conference where 48 participants were asked to make specific suggestions as to how

Denmark could get the best talent programmes in the world (Undervisningsministeriet, 2005). The conference was organised by the Danish Ministry of Education, which in subsequent years had a pool of funds for talent activities. Some of these funds went into creating some of the activities suggested at TalentCamp05 e.g. a national centre for talent development (specifically in the fields of science). Five years after TalentCamp05 the national effort in talent development was evaluated in the *Talentrapport* (Hermann et al., 2011).

At TalentCamp05 the working definition of talent was: children and youngsters with special preconditions within one or more fields, enrolled in normal schools; a person who is good at something and with the possibility of being one of the best if his or her potential is stimulated (Kyed, 2005) (my translation). In the *Talentrapport* talent was defined as: when children and youngsters in the educational system have special abilities within one or more fields, have the desire and willingness to provide an extra effort and have the possibility to become one of the best if their potential is stimulated (Hermann et al., 2011) (my translation). In other words, in a Danish context, a talented young person seems to be someone enrolled in education, with existing ability and the potential to develop this ability to a very high level.

6.2 DANISH RESEARCH ON GIFTEDNESS

The Danish field of research on giftedness is small. The work that has been done mostly focuses on reporting on or evaluating specific activities (cf. Andersen, 2013; Nissen-Schmidt and Andersen, 2012; Olesen, 2013). Other research on giftedness in Denmark focuses on identification and the wellbeing of gifted students (cf. Kyed, 2005; Nissen, 2011; Mogensen, 2012). Baltzer, Kyed and Nissen have produced several studies on giftedness in Denmark both in collaboration and individually (cf. Nissen and Baltzer, 2010, 2011; Baltzer et al., 2006; Kyed, 2007). Their work mainly focuses on what happens and what can be done at school, primarily in the classroom.

Following TalentCamp05 a lot of talent activities were initiated and during 2010 and 2011 an evaluation of the effect of these activities was conducted. The evaluation resulted in what is now known as the *Talentrapport* (Hermann et al., 2011) which summarised *Talentindsatsen i Danmark*, a report made by the consultancy firm NIRAS (NIRAS, 2010). The *Talentrapport* gives a series of suggestions as to what should be done for talented young people in Denmark, which will be discussed and related to current activities in Part 2. The report also gives an overview of the trends in Danish research on giftedness. It points to the fact that most research has focused on (elementary) school and has adapted American and English research to a Danish setting (Hermann et al., 2011, p. 18). In line with Danish teaching

traditions a lot of the research has specifically been on how to accommodate gifted learners in a differentiated teaching setting (Hermann et al., 2011; Rasmussen, 2010b).

In June 2010, half a year before NIRAS finished their report a master's thesis was presented at the University of Aarhus studying what action plan and reasons formed the basis of the talent programmes and activities in Denmark and how the reasons and methods corresponded to national and international recommendations (Rasmussen, 2010c). To answer this a person in the leadership of ScienceTalenter in Sorø was interviewed as well as the coordinator of a smaller talent activity. Rasmussen concludes that the Danish talent activities are initiated for a variety of reasons and that there is a difference between intelligence and talent in the Danish context.

6.3 ASPECTS TO BE EXPLORED

The *Talentrapport* pointed out that most giftedness research in Denmark has focused on (elementary) school (Hermann et al., 2011, p. 18). Today some activities for gymnasium students have been evaluated (cf. Nissen-Schmidt and Andersen, 2012; Olesen, 2013), adding to our knowledge about giftednessin older students. However, these are all specific to an activity and therefore do not tell much about what could be done in general and how these activities might be related. This will be explored further in Part 2.

To what extent does the Danish effort in the field of talent development fit the reasons that are given for it? Which activities do we need more of? Who are the participants and how many activities do they participate in?

In 2010 there were 51 different initiatives dealing with talent development in the Danish educational system according to NIRAS's report *Talentindsatsen i Danmark* (NIRAS, 2010, p. 19). I have accounted for about 40 activities (see ind.ku.dk/projekter/talent), but many more are likely to exist as local initiatives in individual schools. In Part 2, I will look at the aims of these initiatives in order to decide what kind of activity they have. How well the combinantion of these activities fit the need is hard to tell. However, based on the types of activities I will make some suggestions as to potential changes and improvements. Participation and outcome is beyond this thesis.

Nissen (2014) outlines a questionnaire based method for the identification of gifted students. Kyed has also suggested guidelines for identification (Kyed, 2005) and has further shown that if not properly catered for they may end up with social issues (Kyed, 2007). One suggested method of is to create special classes for gifted students (Nissen and Baltzer, 2011). In Part 3, I have examined the initiation of a new talent class and focused on how the implied student, a concept which I will introduce later, develops along with the new programme.

There are of course many more aspects of giftedness that needs to be researched both in Denmark and in general.

Part II

TALENTACTIVITIES IN DENMARK

7

SITUATING MY STUDY

7.1 A SHORT INTRODUCTION TO THE STUDY

What are we doing for the talents in Denmark? That is one of the main questions of this thesis as described in Chapter 1. In this part of the thesis I will answer that question. The approach I will take will lead me past the question of how the format of the talent activities relate to the aims of the activities and how well they fit with the national strategies and motivations for talent development. It is a large task and of course not all aspects can be covered equally, so I have chosen to focus in particular on creating and using a model for distinguishing between the different types of activities, not based on their format but based on their aims. To tell how well they fulfil those aims I would have to make separate studies of each activity. Needles to say, this has not been done here; instead I have decided to look at the number of activities focusing on different kinds of aims. From this I have been able to identify kinds of aims that are covered by a large variety of activities and others which are only covered by a few and sometimes only by a specific type of activities. This might give us some idea of where we need to increase our attention if we want the combined efforts of the talent activities to become more effective.

7.2 BACKGROUND

The "Talentrapport" (Hermann et al., 2011) gave a long list of recommendations for what should be done to improve the quality of talent development in Denmark. This was done based on surveys among school leaders, teachers and a sample of the general public (NIRAS, 2010). The main critique of the field in general by the "Talentrapport" is that the combined effort of the activities lacks direction and is not systematic (Hermann et al., 2011, p. 10). In 2009 the organisation ScienceTalenter was formed with the purpose of coordinating this effort and it will be interesting to see what effect they have had, when their work is evaluated later this year (ScienceTalenter, 2013). While that evaluation will focus on ScienceTalenter's involvement this thesis will approach the problem from the view of the talents.

In his master thesis Rasmussen (2010c) suggests that the reasons for initiating talent activities vary a lot and that the activities do not agree on a definition of the terms "talent" and "talent development". Rasmussen made his investigation based on interviews with a memeber of the leadership team from ScienceTalenter and a local project

in Jutland. This investigation is made based on a collection of information on all the talent activities I have been able to find. This of course gives a less detailed view of each activity, but it allows for more activities to be included.

At TalentCamp05 three principal reasons for carrying out talent development in Denmark were given (see Chapter 1). One was the need for more innovation in Denmark, in order to to be successful in an increasingly globalised world. Another was a claim that "talent is contagious", meaning that the presence of a talented peer in the classroom will raise the level of the rest of the class. The third and last reason given for doing talent development in Denmark was to increase the social wellbeing of the talented students. Some activities are probably better than others at working towards these reasons and as such we should take this into account before students are enrolled in talent activities so that they do not take up a spot for a more needing student.

This study has been made to see if it is possible to classify talent activities in a way that gives us information about the general distribution of said activities and how they can play different roles in the development of a talent within the individual student.

7.3 A NEW LOOK AT TALENT ACTIVITIES

A lot of models of giftedness or talent find it sufficient to distinguish between whether or not a student is gifted/talented or not. To look at how a student's talent develops a model is needed that sees talent as a process rather than a state; a model that shows what can be done to improve or develop an existing or potential talent. Gagné's Differentiated Model of Giftedness and Talent (DMGT) is one such model (Gagné, 1985). For this study I have used the most updated version of the DMGT (Gagné, 2010) and looked at how it can be used to describe the necessary activities to make a gifted student a talented student. The use of this model is not new in Denmark. It was referred to in the "Talentrapport" (Hermann et al., 2011, p. 14), Rasmussen (2010c) used an adapted version of it and Kyed (2005) used it as an example of models using a collective notion of giftedness.

The previous studies on the combined effort in talent development in Denmark from Hermann et al. (2011) and Rasmussen (2010c) used questionnaires and interviews as their method to find the effects of the activities. This study, however, does not look at actual effects but rather at the intended effects in the form of aims for the activities. It also looks at what kinds of activities there are and then seeks to figure out how well they cover the need for different kinds of activities. This may give a new look at what talent activities actually do for the gifted and talented students in Denmark.

8

THEORY

8.1 WHO IS WHO? DEFINING GIFTED AND TALENTED

There is no consensus on what defines gifted and talented students. In many cases the words are used with the same meaning. Until now I have used the same words as each referenced author without being too clear about which definition was used unless strictly necessary. However, for the remainder of this thesis it will be necessary to make clear what is meant by the two terms. I have chosen to use definitions similar to those used by Gagné (1985, 2004, 2010) in relation to his Differentiated Model of Giftedness and Talent (DMGT). These definitions were chosen because the DMGT will be the model of choice to describe the activities and processes related to the subject matter. The definitions used by Gagné have developed over the 25 year period between the first and the latest article on the DMGT so his treatment of the model is not completely consistent between articles. I have decided to use the version 2.0 from 2010, but will make comments on where it has changed throughout this chapter.

8.1.1 *Gifted students*

According to Gagné (1985, 2004, 2010) giftedness relates to a series of natural abilities, which are not performance specific. Among the natural abilities are those that can be measured using IQ tests and other models of intelligence such as the multiple intelligences (Gardner and Hatch, 1989) and the triarchic model (Sternberg, 1985). It does, however, not only cover intellectual abilities. Creative, social, perceptual, muscular and motor control abilities are also included as domains in what Gagné (2010) considers giftedness (see Figure 1). The natural abilities are not innate, but rather a result of both nature and nurture. They develop especially during childhood. As reported in the review of giftedness literature (part 1) there is an abundance of cut-off points for when someone should be considered gifted, ranging from the top 20 percent to the top 0.025 percent (Gagné, 1998b). A cut-off point like this will always be somewhat arbitrary. Therefore, I have chosen to consider giftedness as a continuum so that it is not a question of whether or not a student is gifted, but rather a question of how gifted the student is. This breaks somewhat with Gagné's model since he believes only gifted students can become talented students. When considering the level of giftedness one should not consider the sum of all domains, but rather the sum of relevant domains for the type

It is worth noting that in the first version of the DMGT (Gagné, 1985) the word competence is used to describe giftedness, whereas in the later DMGT 2.0 (Gagné, 2010) competence is used as the category for talent. This might cause some confusion when rereading the articles, but I have made sure to only use competence in relation to talent here.

of giftedness one is considering. In other words if you are trying to judge how gifted a student is in relation to science subjects it is probably not relevant to look at how gifted the student is in the muscular domain.

To summarise: giftedness is a measure of how developed a student's natural abilities within relevant domains are relative to his or her peers. Natural abilities are not performance specific.

8.1.2 *Talented students*

Gagné (2004) remarks that his use of the words domain and field should not be confused with the way Csikszentmihalyi uses them (cf. Csikszentmihalyi and Robinson, 1986). Csikszentmihalyi's use is more macroscopic and contains a societal outlook compared to Gagné's which he states is more from a psycho-educational point of view.

"Talent refers to performance which is distinctly above average in one or more fields of human performance (Gagné, 1985)." This is how Gagné originally defined talent. In his latest revision of the DMGT he elaborates that "talents progressively emerge from the transformation of these outstanding natural abilities or gifts into the well-trained and systematically developed competencies characteristic of a particular field of human activity (Gagné, 2010)." This means that a talented individual has learned to do something and is really good at it. Ericsson et al. (1993) use a definition of expertise which largely overlaps with the DMGT's version of talent according to Gagné (2004) (see Section 4.3 for more on the expert approach).

Gagné emphasises that to become a talent you must be gifted but the opposite is not the case. Mathematically this seems to give him a problem since he has decided to use the top 10 percent as a cut-off point for both gifted and talented. However, the top 10 percent is chosen from each domain and each field so, according to one of his 1998 articles (Gagné, 1998a), this means that almost 50 percent of a population is gifted in some area. This saves his definition but possibly dilutes it more than some people would like, seeing as 10 % is already a broad definition compared to most others.

Again for my use of the word talent I have chosen to see it as a continuum and not create an arbitrary cut-off point for when you are talented and when you are not.

To summarise: talent is a measure of how well a student performs within a specific branch of a field relative to his or her peers.

8.2 THE DIFFERENTIATED MODEL OF GIFTEDNESS AND TALENT

Now that we have a clearer idea of the children we are talking about when we say gifted and talented, it is time to take a look at the Differentiated Model of Giftedness and Talent (DMGT) itself. Figure 1 shows an adapted version of it. The DMGT takes as its starting point the group of gifted students. From here they undergo a developmental process that is influenced by two groups of so called catalysts: the environmental and the intrapersonal. If the developmental process has the correct content and format and is properly catalysed the

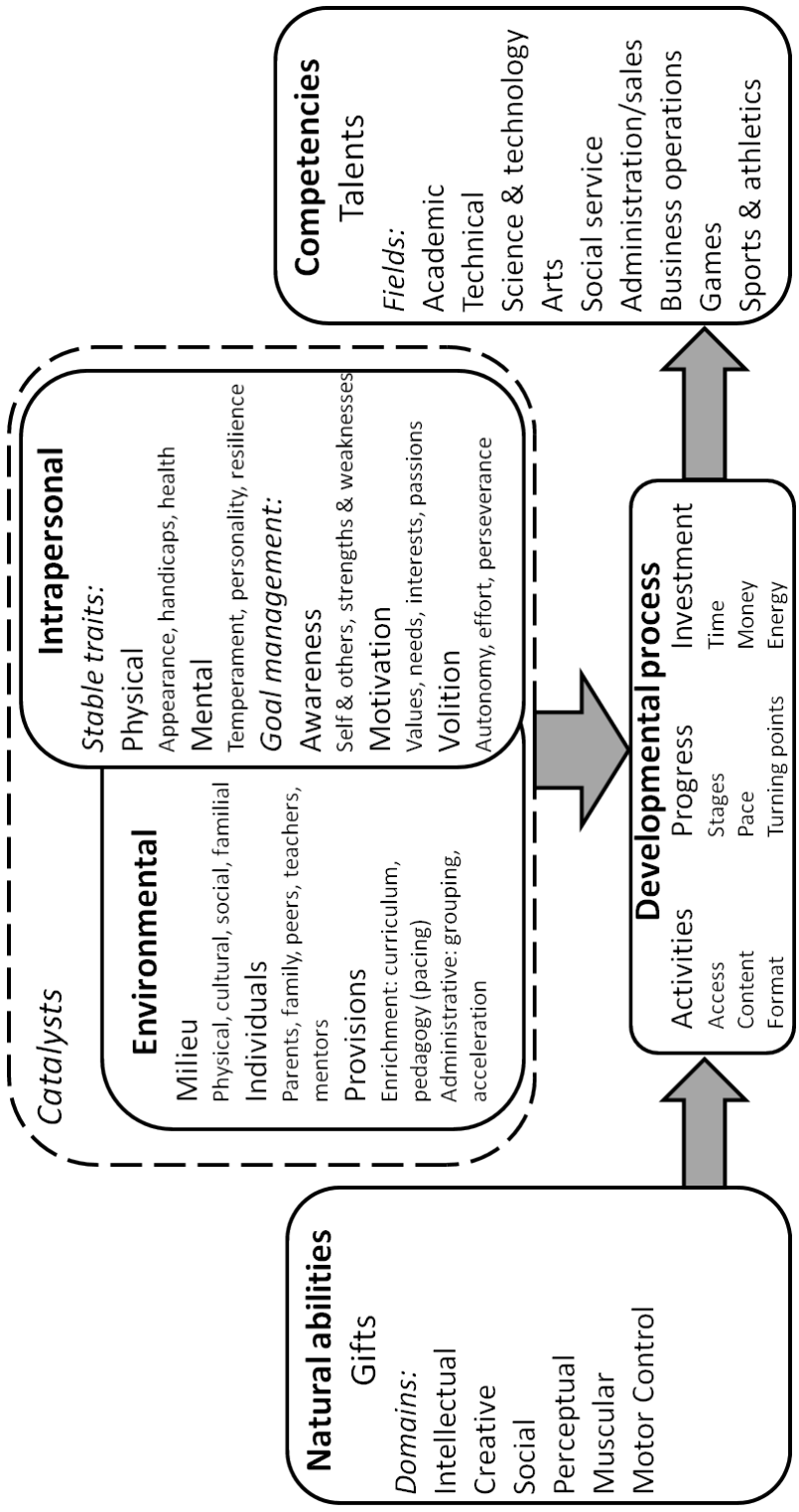

Figure 1: Adapted version of the Differentiated Model of Giftedness and Talent 2.0 from Gagné (2010) w/o Chance

gifted students become talents. Gagné also has an element of chance that works on all parts of the model except talent. I have chosen not to include this element because I think it is more correct to see it as the result of feedback between parts in the model. This will be elaborated upon in Section 8.2.3.

For now let us take a closer look at the main parts of the model.

8.2.1 *Developmental process*

The developmental process is probably the part of the DMGT which has evolved the most since 1985. In the first version it was not included (Gagné, 1985). Instead it seemed as if the gifted would simply become talented if the right catalysts were present. In the 2004 update (Gagné, 2004) the developmental process was introduced as the processes under which the gifted develops their natural abilities into talents. In the 2004 version the model distinguishes between maturation, informal learning, formal non-institutional learning and formal institutional learning, as processes of developing gifts into talents. Some of these processes are noted to be more useful than others for developing certain kinds of talent.

In the DMGT 2.0 Gagné (2010) has become more restrictive in what he considers part of the developmental process. He defines it as "the systematic pursuit by talentees, over a significant and continuous period of time, of a structured program of activities leading to a specific excellence goal (Gagné, 2010, p. 84)." Talentee is a new term he introduces as the name of a person participating in a talent development program. This definition makes it clear that developmental processes are the result of focused work. It seems very similar to the concept of deliberate practice (Ericsson et al., 1993) which corresponds well with the earlier remark that expertise overlaps with talent. It is this version of the developmental process I have chosen to use.

8.2.2 *Catalysts*

A catalyst is something that initiates or accelerate a process.

The catalysts of the DMGT are what influence the developmental process. It is clear that simply offering a developmental process to a gifted student does not make him or her talented. The student needs to be motivated to take part and it has to be acceptable to take part in the process both socially and culturally. Gagné (2010) includes two kinds of catalysts in the DMGT 2.0, the intrapersonal and the environmental, which will be described in this subsection. The content of these are possibly just as important as the natural abilities for the developmental process (Duckworth et al. (2007) would probably place grit as part of the intrapersonal catalysts and thus say that they are the most important).

Intrapersonal

For the intrapersonal catalysts Gagné (2010) distinguishes between stable traits and those related to goal management. The further subcategories of these can be seen in Figure 1. In part 1 when dealing with the expert approach I introduced the concept grit and called it a special kind of motivation. In the DMGT grit should be considered a combination of motivation and volition under goal management. Both motivation and volition is needed for developing a talent. Motivation is the desire to become a great runner or physicist. Volition is the will to go running even though it is raining or spending the weekend in the lab just to work out that little detail.

Your physical and mental traits also play some part in the development of a talent. If you have bad health and thus need to stay home in bed every other week it is quite hard to become the best at something. Of course there are exceptions where physical handicaps may be outweighed by great perseverance or passion, as for example in the case of the physicist Stephen Hawking (Mialet, 1999).

Environmental

In the updated version 2.0 of the DMGT Gagné (2010) argues that the intrapersonal catalysts function as a filter for some of the environmental catalysts, but remarks that "the bulk of environmental stimuli have to pass through the 'sieve' of an individual's needs, interests, or personality traits" (Gagné, 2010, p. 85). This is shown in the graphical representation by letting the environmental catalysts overlap the intrapersonal catalysts with the latter on top (see Figure 1).

Among environmental catalysts there are three categories in the DMGT 2.0 (there was an extra in earlier versions but "events" as it was called seems to have been dropped). Milieu is the first of the three categories. This covers physical, cultural, social and familial environmental factors, such as whether a person lives in a rural district or in a metropolis, or the traditions of the culture they live in e.g. gender equality and what subjects are considered important. The second category is individuals. Many of the greatest talents or experts within a field make reference to specific individuals as having some responsibility for their great achievements, due to their motivation, mentoring and support (Gladwell, 2008; Buhl, 2010). The third category is called provisions and is more or less exactly what Montgomery (2006) talks about (see Section 5.2). Gagné (2010) points to the parallels between this category and the activities category in the developmental process. The provisions should be seen as the spectrum of available activities in the environment, which are chosen from in the developmental process.

The intrapersonal catalysts are those aspects which may influence the developmental process that are based in the talentee, be it physi-

cal or mental traits. The environmental catalysts in contrast are those aspects which may influence the developmental process but are based in the surroundings of the talentee both in the form of physical environment and social environment.

8.2.3 *Chance or dynamics and feedback*

The DMGT gives a detailed description of which factors influence the development of a talent. How the factors influence each other is implied in the articles that follow with the model but not to a sufficient degree, in my opinion. Natural abilities are not fixed they develop over time and the environment is one factor crucial to this development. Taking part in a developmental process usually gives you feedback in the form of increased or decreased motivation and you are usually bound to meet new people during the process, meaning that your environmental catalyst is being changed. Finally, being a talent in a particular field is not a final destination, as one might be mislead to believe from looking at the model. It takes continuous deliberate practice to remain a talent and it usually changes the environment you are in. In fact all parts of the DMGT should probably be connected by arrows going both ways indicating some sort of influence, but this would obscure what the model is actually trying to tell us. The DMGT tells us what factors influence the developmental process from gifted to talented. The focus of the model is on the developmental process.

8.2.4 *What can the DMGT be used for?*

The DMGT describes which factors should be taken into account when developing a talent. It makes it clear that we cannot simply offer a developmental process to a gifted student and expect him or her to become a talent by simply taking part in it. The talentee must also be situated in an environment that encourages the development rather than hinders it and have the right mindset for taking part in the process.

The DMGT gives us a distinction between gifted and talented, which we can use when determining who should gain from an activity and what they should gain. In fact it shows us that sometimes it can be relevant to offer activities for the gifted and/or talented which are not developmental processes, but rather activities which alters the catalysts for the developmental process.

In the next section I will describe a distinction I have made between different kinds of talent activities based on their aims for the talentee.

8.3 TYPES OF TALENT ACTIVITIES

Talent is not something that appears out of nowhere. It takes a developmental process and for that to take place, the conditions for the process in the form of environmental and intrapersonal catalysts must be present for a person with certain gifts. To create the optimal conditions activities can be devised to change the state of the catalysts. The sudden appearance of a mentor is a change in the environmental catalysts which might open up for access to new developmental processes and an inspirational lecture might spur the motivation to move into a whole new field. In my work with mapping the talent activities in Denmark I noticed some tendencies in the aims of the activities, which led to a qualitative classification of the activities (cf. Petersen and Johannsen, 2014). For this part of the thesis I have used this method of classification to map the talent activities in Denmark. The remainder of this chapter will be a description and discussion of how this classification is made and what it should be used for.

8.3.1 *Three types of activities*

In a recent analysis (Petersen and Johannsen, 2014) we have presented a distinction between three types of talent related activities. What is characteristic for all three types of activities is how they focus on creating the optimal conditions for the developmental process. Two of the types focus on modifying a catalyst while the third focuses on the developmental process itself. Most actual activities have more than one aim and do not point to just one type of activity. Often, however, the activity will have a main focus within one or two of the types.

Talent nurture

This type of activity has as its aim to modify the environmental catalysts for a talentee. Most activities of this type focus on either introducing the talentee to a network of people in the field he or she is trying to become a talent in. A few activities lobby for a greater multitude of provisions or may even be creating them. Very few activities work directly with changing the milieu a talentee is situated in.

Interest activities

In the original description of the three types of talent activities (Petersen and Johannsen, 2014) interest activities might have been a bit too restrictively defined. There it describes activities that focus on increasing the interest in a certain topic or field. This is to a large extent what the talent activities in this category also attempt to do, but if it is to be seen as activities that modify the intrapersonal catalysts,

a broader definition must be used. Keeping in mind that the aim of the activities should be to modify the intrapersonal catalysts in a way that creates the optimal conditions for the developmental process, we may stick to focusing on activities that focus on goal management, especially seeing as Gagné (2010) considers the traits category to be stable.

Talent development

Finally, the third type of activities, talent development, focuses on the developmental process in the DMGT. An example of such an activity is enrichment programs at schools where topics are covered in greater detail so as to increase the acquired knowledge of the students. Training camps for the academic Olympiads are a great example. The academic Olympiads aim to create a network between the competitors and thus fall under the talent nurture category instead.

8.3.2 *Aim or format?*

The three types of talent activities described above are mechanisms which can be used to change conditions under which the current developmental process of a talentee is taking place. Talent nurture and interest activities aim at changing the catalysts to ease the developmental process. Talent development describes activities which focus on handling the developmental process.

This categorisation of talent activities has got nothing to do with the format of the activities it only focuses on the content. Both competitions and talent classes can be considered talent nurture if their aim is in that direction. This is not to neglect the importance of format. It is merely to show that the aim of an activity is at least just as important. Creating all kinds of different formats for talent activities is not a sufficient effort to create the optimal conditions for the development of talents. Neither is creating activities with the same format of all three types of activities. To create the optimal conditions for the development of talents activities of multiple formats and of all three types of activities are needed.

In this chapter I have defined the terms gifted and talented as they will be used in the rest of the thesis. I have also introduced the DMGT, which will be the model of choice for analysing what talent activities are doing for their participants and what that tell about who the participants are. As a tool for making this analysis I have divided the talent activities into three different types: talent nurture, interest activities and talent development. These types distinguish between the aims of the activities rather than the format.

In the next chapter I will describe the method I have used to find the talent activities, to classify them and finally how I analysed them.

9 METHOD

Before I began my research there was no comprehensive list of talent activities in Denmark.

While the list of activities I have comprised is not complete, it contains all of the major activities and many of the minor ones. In 2010 NIRAS made a similar list using information from the Danish ministry of education (NIRAS, 2010). This list, however, only contained information about activities which had received funding from the ministry. Today most of these funding pools do not exist.

Even though the list is not complete it contains enough activities to identify all three activity types described in the previous chapter. Based on the distinction between the activity types and a distinction based on the format of the activities, described later in this chapter, I have analysed the distribution of activities through different cross sections of activity type and format.

This chapter will describe how I made my list of talent activities, what criteria I used, how I classified them and how I later analysed them.

9.1 CREATING A LIST OF TALENT ACTIVITIES

I began compiling a list of talent activities by writing down those I already knew. I started creating this shortly after attending the first Nordic Talent Conference in Sorø. This was hosted by ScienceTalenter and attended by representatives from various talent activities. I was able to add the names of these to the list. For the last ten years I have volunteered for the Danish Youth Association of Science (Ungdommens Naturvidenskabelige Forening - UNF). Over this period I have learnt a lot about various activities. UNF also has a website with a long list of links to science competitions and science related activities in Denmark. The list is somewhat outdated but was still a useful source of information. I was also able to find information at www.emu.dk, a website created by the Danish ministry of education as a meeting place for educators and students in Denmark. Finally I also found a few activities through personal contacts.

As earlier mentioned this list is not complete. In April I attended the competition Unge Forskere which is the biggest science competition in Denmark. From talking with some of the participants and their teachers I learned that many schools had their own small talent activities in the form of extra classes where the students can work on projects, learn about topics not covered by the curriculum or go on

excursions for example to activities organised by UNF. Since participation in these activities is restricted to the school there is usually very little if any information publicly available about them and what may be available is likely to be outdated.

9.1.1 *Criteria for being a talent activity*

Rasmussen (2010c) reported that the people behind the competition Science Cup did not see their activity as talent development, because everyone could participate and they also focus on presentation and interdisciplinarity. I have, however, included Science Cup on my list. This begs the question: what is a talent activity?

I have taken a very broad approach to what I accept as talent activities. Not all activities are related to academic talents, not all of them define themselves as talent activities and not all are in fact active in Denmark. The activities which are not academics are included because they can tell something general about talent activities. Those which don't define themselves as talent activities have been included because other activities with a similar format do or because a part of their activity effectively is talent development. Those which are not active in Denmark are academic Olympiads which Denmark previously have taken part in or could potentially take part in.

I have decided not to include any sports activities because they seem too distant from a traditional educational setting, which is the focus of this thesis.

In general the activities, which have been included, are or could be improving children and youngsters' chances of becoming a talent.

9.1.2 *Finding information on the activities*

For each talent activity I have tried to find information on target group, field, background, a short description, aims, price, sponsors, size and webpage. Most of the data was accessible on the activities' webpage but in some cases I had to find the information by more direct queries such as email or personal contact or try to extrapolate it from other descriptions. Of the gathered information it has mostly been the short description and the aims, which have been used for analysing the activities.

9.2 CLASSIFICATION OF ACTIVITIES

Based on the aims and the short descriptions of the talent activities I have made two kinds of classification of the activities. The first classification sorts the activities into the three types of activities described in the previous chapter i.e. talent nurture, interest activities and talent development. This classification has been made based on the aims

of the activities. The other classification sorts the activities by their format and uses six classes. The following is a short description of how the classification was made.

9.2.1 *Aims*

When the aim of an activity is "to promote the interest for and knowledge of science and technology, primarily among youngsters" it is easy to classify it as an interest activity, but not all activities are so easy to classify, using the three types of talent activities, especially not when they don't tell what their official aim is but simply describe their activity. Some activities have multiple aims, which relate to more than one type of activity.

To classify the activities I have focused on what the activities' aim for their participants is. To be classified as talent nurture their aim should relate to increasing the social network of the participants, change the milieu the participant experience in their daily life or attempt to make new provisions available for the participants. These aims lead directly back to the subcategories of the environmental catalysts of the DMGT (see the previous chapter).

To be classified as interest activities their aim should focus on improving/maintaining motivation or increasing awareness of a certain topic. I haven't encountered any activities which tried to change what Gagné (2010) calls the intrapersonal traits of the participants, but such activities could be considered this type of activities as well if the desired change of traits were beneficial for the developmental process. Motivation and awareness are the central subcategories of the intrapersonal catalysts besides intrapersonal traits in the DMGT.

To be classified as talent development their aim should be to improve the participants' competence in a field. Many activities do this but primarily as a tool for reaching another aim such as improving the interest in a field or creating a network among youngsters with similar interests. The process of talent development is exactly what leads a gifted student to become a talent and is thus the actual developmental process of the DMGT.

9.2.2 *Format*

Talent activities come in many shapes and sizes. A lot of them, however, seem to copy others or just use the same basic model with some alterations. An example is the academic Olympiads. There are academic Olympiads in chemistry, biology, physics, mathematics, astronomy, linguistics, philosophy, informatics and geography.

To sort the talent activities I have chosen six different categories for the activities. The categories are: academic Olympiads, competitions, online activities, leisure activities, pull-out activities and talent

classes. The difference between academic Olympiads and competitions usually lies in whether or not the participants are tested at an event or brings a project to an event. Online activities are fully organised on the Internet. Leisure activities take place without relation to school activities usually in the evening or during holidays. Pull-out activities can be very similar to leisure activities but have some connection to the participants' school. Talent classes are based in long term structural changes in the organisation of a school class, usually with an emphasis on acceleration or enrichment.

These six categories successfully distinguish between all kinds of talent activities I have found. Some of the activities use other activities as part of their program, but in a manner that keeps the classification for both activities. It is possible that there exist activities which would not fit any of the six categories as they have been chosen based on what activities I have found.

9.3 METHOD OF ANALYSIS

To analyse the list of talent activities I decided to look at them through a series of cross sections, both based on activity format and activity type. This was done to find tendencies in the ways certain talent activities define their participants and what blind spots there might be in the talent activities. Through this I hoped to be able to learn more about what kind of talents the activities pointed towards, in other words who we are doing the talent activities for.

Having taken this approach I tried to combine all the cross sections into one to get as full a picture as possible of the talent effort and what general trends there might be. I also tried to look at how the activities related their aims to their formats and what this might tell about the original order of the two, that is which came first.

10 RESULTS AND DISCUSSION

In this chapter I will describe the distribution of activities on the different activity types and formats, which I have found.

37 activities have been included in the analysis. They have all been categorised by activity type and format based on their official aims and the short description of their activity. 15 of the activities are also described by a secondary activity type. Since it cannot be determined how great a part the secondary activity type plays it has been accounted for as being equal to the primary. Appendix A is a table showing the categorisation of the activities.

The first thing to be covered in this chapter will be the distribution of activity formats on different types of activities. The next section will take the opposite cross section and describe the distribution of different types of activity on activity formats. Finally the last section will look at combinations of the two and other general aspects of talent activities.

37 activities may seem like a lot of activities and it is if you are analysing them together, but when split into six categories of which two only contain three activities it becomes somewhat problematic to say anything general about some types of activities. The online activities and the talent classes are very few in numbers, but as it was pointed out in the previous chapter there are quite a few activities which have not been included here, but could have been.

The statistical significance of the findings here is in general quite low, but some of the findings point to certain trends in talent activities and this is where it gets interesting. These general trends can be used to figure out how what we are doing points to certain types of students whom we are doing it for. This will be done in the last section of this chapter.

At the beginning of each subsection describing an activity type or format there is an example of said activity type or format for giving a concrete relation to what is analysed.

10.1 ACTIVITY TYPES

The aim of the International Olympiad of Informatics (IOI) is defined as:

"The primary goal of the IOI is to stimulate INTEREST *in informatics (computing science) and information technology. Another important goal*

Activity type	No. of activities	Overlaps	% overlap
Interest activities	13	8	62 %
Talent nurture	21	14	67 %
Talent development	18	8	44 %

Table 1: Distribution of talent activities on activity type

is to BRING TOGETHER*, challenge, and give recognition to young students from around the world who are the most talented in informatics (computer science), and to* FOSTER FRIENDSHIP *among these students from diverse cultures."*

The first part of the aim clearly makes it an interest activity, while the second part of the aim contains aspects of talent nurture. This gives an overlap in the activity type of the IOI.

Out of the 37 talent activities 13 should be considered interest activities, 21 talent nurture and 18 talent development (15 activities are considered to be described by two activity types. See the shaded box for an example). Table 1 1 shows that 67 % of the talent nurture activities and 62 % of the interest activities are described by more than one type of activity, while it is only 44 % for the talent development activities. Another interesting aspect of this is that only in one instance is there an overlap between interest activities and talent development; all other overlaps include talent nurture as one of the activity types.

Figure 2 shows how the different activity formats are distributed on the activity types. Figure 3 shows the same distribution using percentage of activities with the same format instead of total number of activities. The content of these figures will be the topic for the remainder of this section.

The 37 activities are spread out over all three activity types and 40 % of them belong to two activity types. All of these overlapping activities except for one include talent nurture as one of the activity types. In most of the cases it is because the activities have a social aspect in the sense that they want to create networks between the participants. This is especially clear in the case of academic Olympiads. As the overlaps are so focused on talent nurture it will be discussed further in that subsection.

Talent development activities are much less likely to be overlapping with other types of activities. This may not be so surprising if we look at the DMGT, since talent development is an active part in the model (the developmental process) whereas the two other types are indirect parts which are modifying the catalysts. The activities might effectively also be performing talent nurture and interest activities but the focus is on the direct development.

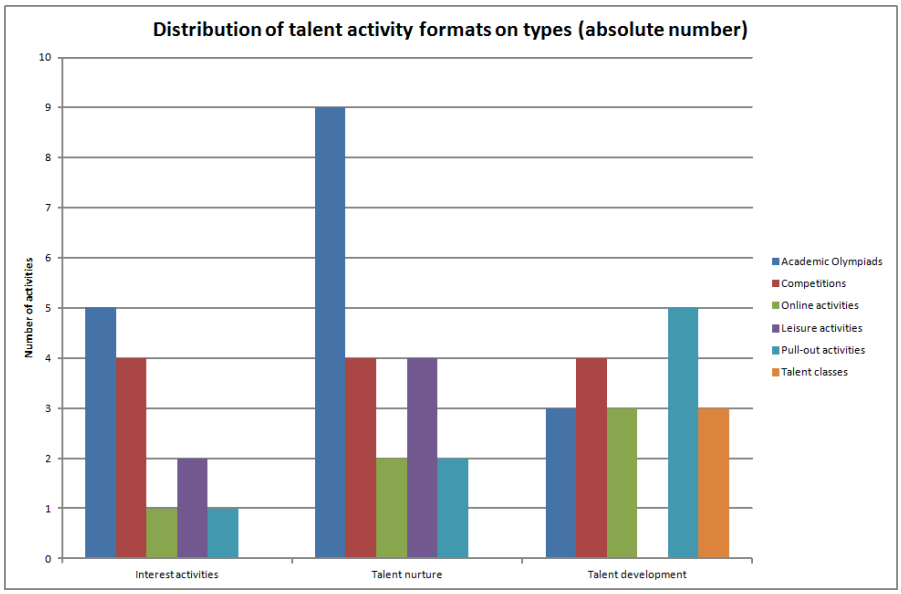

Figure 2: Diagram showing the distribution of different activity formats on talent activity types

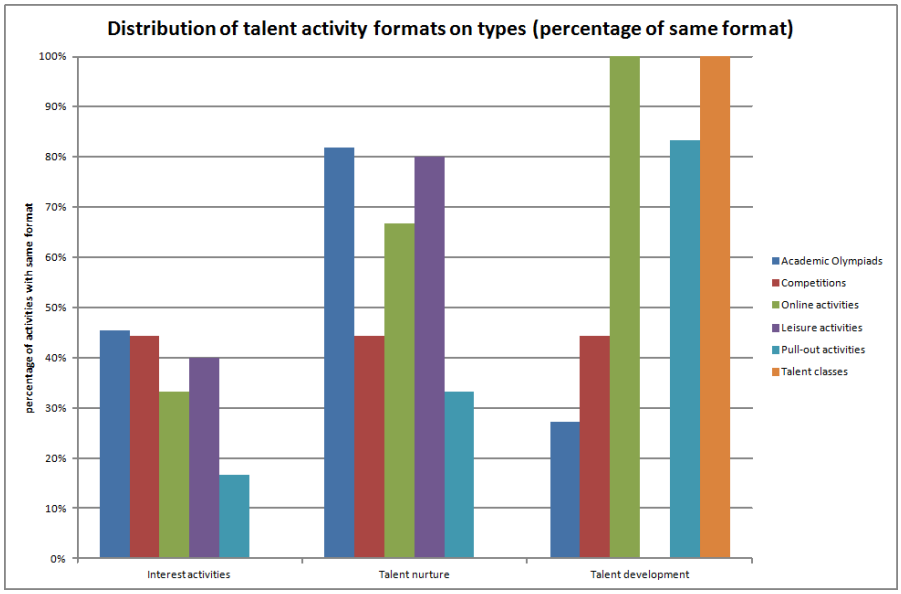

Figure 3: Diagram showing the distribution of different activity formats as percentage of activities of that format on talent activity types

10.1.1 *Interest activities*

The aim of FIRST LEGO League is defined as:

*"*To INCREASE THE INTEREST *among young people for technology and science and stimulate present day's youngsters to become the future's engineers and researchers." (My translation)*

Since the activity aims at increasing an interest it falls under the category of interest activities.

The majority of interest activities are academic Olympiads and competitions (see Figure 2). When we take the total number of activities of similar format into account as is done in figure Figure 3, we see that for academic Olympiads, competitions and leisure activities approximately 40 % of the activities are interest activities. Online activities and pull-out activities each have one activity categorised as being an interest activity and there are no talent classes that can be considered interest activities.

So while this type of activities seems to be dominated by academic Olympiads and competitions, when we look at the relative number of activity formats leisure activities also seems to be well represented under this activity type. If we look at the activities which are less present under this activity type we find the online activities, pull-out activities and talent classes. There are plenty of activities on the Internet which attempt to increase the interest in science (for examples see Section 10.2.3), but because of their very broad aim I have not included them here. Pull-out activities and talent classes may not really need to be interest activities, because of the way they choose their participants. Their participants are often chosen based on an existing interest for a certain topic, the two biotech talent classes for example choose their students based on a motivation for biotechnology (much more on this in Part iii). Pull-out activities which focus on increasing motivation are starting to appear. Talent med bredde is one such activity.

When I introduced interest activities in Section 8.3.1 I problematised how the name seems to be misleading if it is supposed to cover all activities focusing on the intrapersonal catalysts. This does not seem to be a problem anyway. Almost all of them use exactly the word interest when defining their aims. Increased motivation occurs a few times and in one case (Talent med bredde) the aims also consider other personality factors.

The choice of using interest as the title of this type of activities may not represent the spectrum of activities which could be changing the intrapersonal catalysts, but it mirrors the actual activities.

It seems the interest activities are covering a lot of ground and uses multiple activity formats to increase the interest in science. A

relevant question to ask in relation to this is how effective they are. The only study that I know of which have measured this is one by the University of Copenhagen, which in 2009 asked new students at the faculty of science, whether certain activities had had an impact on their choice of study (SCIENCE, 2009). This study showed that UNF (one of the leisure activities) had an influence on the choice of study for more than 5 % of the new students.

10.1.2 *Talent nurture*

The aim of Biotech Academy Camp is defined as:

"To give the students insight into WHAT IT MEANS *to study biotechnology and* WHAT ONE DOES *in the industry as a trained biotech engineer." (My translation)*

Since the activity aims at preparing the students for the environment further in their studies and professional life it falls under the category of talent nurture.

Talent nurture seems to be the major focus of both academic Olympiads and leisure activities, both having approximately 80 % of their activities involved in this type of activity. Online activities are also well represented here with two out of the three activities. Competitions and pull-out activities are also represented but in more modest numbers. Talent classes are again completely absent.

It is a common belief that the gifted and talented are social outsiders and rightly so. As reported in Section 5.2 many of these students end up being bullied or keeping a social distance to the other students (Montgomery, 2006; Kyed, 2007). This is one reason why so many talent activities might have talent nurture as one of their aims. In doing so they attempt to increase the social well-being of the students; one of the three reasons for doing talent activities (see Chapter 1 and Section 7.2).

All activity types except for talent classes are represented in this category of activity types. The two biotech classes, however, are involved with talent nurture; they just don't put it down as one of their aims. The principal of the biotech class in Bagsværd has said that he considers the class a sanctuary for the talents (Pank, 2012), and as such it must be some kind of talent nurture. Unfortunately the comparison to a sanctuary clearly shows how they effectively work against the second reason for doing talent activities, which is the idea that talent is "contagious" (see Chapter 1 and Section 7.2), by grouping those who are already talented.

Almost all of the talent activities involved in talent nurture are focusing on creating networks among the participants. These peer focused networks may be helpful for the students' social well-being,

but if the needed nurture is a change of milieu or available provisions, then the students seem to be on their own.

10.1.3 *Talent development*

The aim of Akademiet for Talentfulde Unge Syd is defined as:
"To give gymnasium students with academic potential a broader and more continuous option with intellectual CHALLENGES AND EXPERIENCES*." (My translation)*
Since the activity aims at providing challenges and experiences for the students it falls under the category of talent development.

Talent development is the activity type where the talent classes are. All of them and the entirety of the online activities are in this type of activity. A lot of the pull-out activities are here as well, but none of the leisure activities are here. Competitions are present at the same level as in the other types whereas academic Olympiads are present to a lesser degree.

Developing a talent is apparently something you do anywhere but in your leisure activities. At least it is not a goal for leisure activities to focus on the developmental process. Online activities, pull-out activities and talent classes are in general the most formal teaching activities and as such it is not surprising to see that almost all of them have talent development as their aim. Formal teaching is one kind of deliberate practice and thus a central part of the developmental process.

The academic Olympiads are only to a small extent focusing on talent development, but since their main activity is to test the participants it is not so surprising, since the act of testing is a summative evaluation process (Miller, 2013) rather than a developmental process. The training camps between the national and the international Olympiads, however, are definitely aimed at being developmental processes, but the training camps are not an aim they are rather a means for the academic Olympiads.

10.2 ACTIVITY FORMAT

Until now I have focused on looking at the categorisation of talent activities by grouping them according to activity type, but the same can be done by grouping them according to format. It's the same data just viewed from another angle. This section will highlight what results come out of considering it in this way.

Figure 4 shows the distribution of activity types for each activity format. Figure 5 shows the same data as Figure 4 but only as a percentage of activities of the same format. It wouldn't make sense to

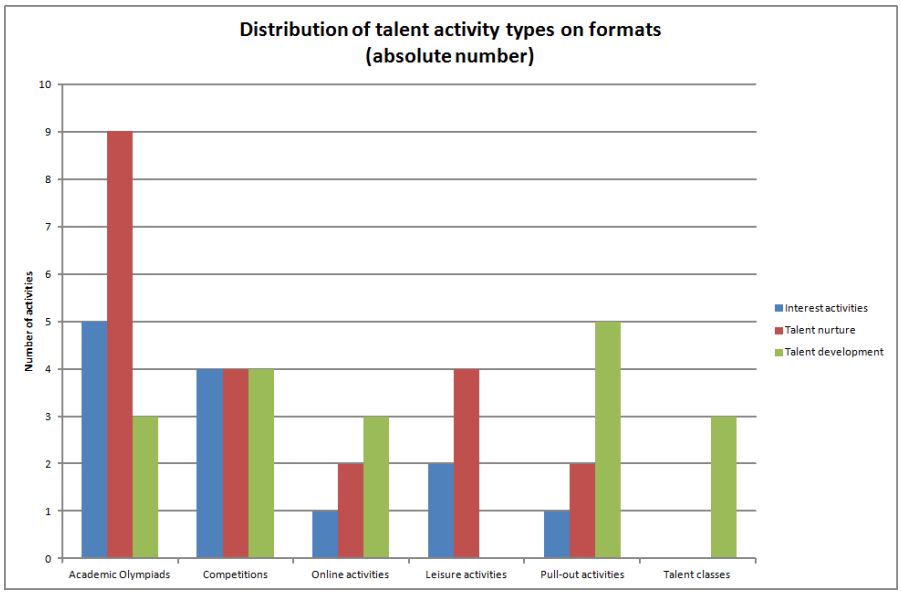

Figure 4: Diagram showing the distribution of different activity types on talent activity formats

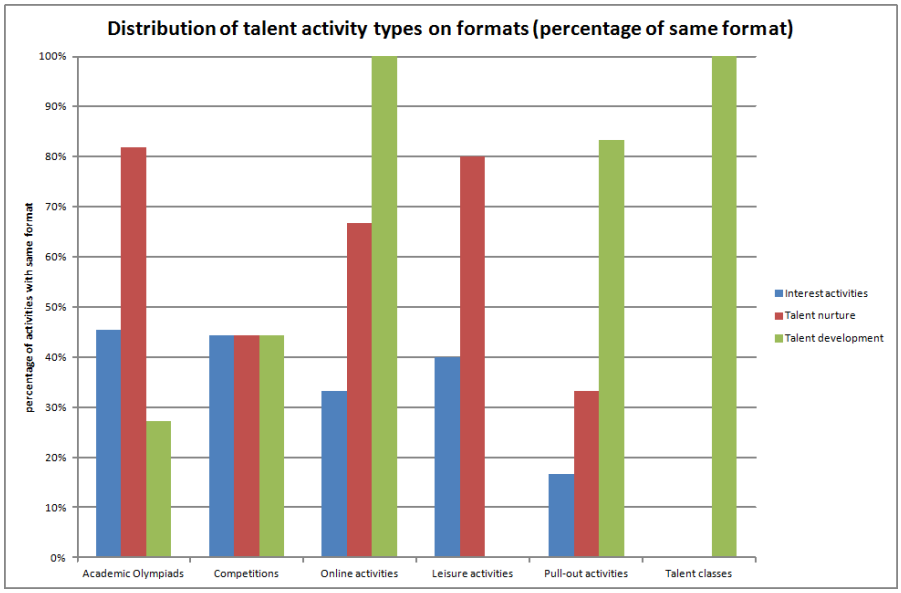

Figure 5: Diagram showing the distribution of different activity types on talent activity format relative to the total number of activities of that format

Activity format	No. of activities
Academic Olympiads	11
Competitions	9
Online activities	3
Leisure activities	3
Pull-out activities	6
Talent classes	3

Table 2: Number of talent activities of different formats

show the same distribution as a percentage of activities of similar type, since I haven't taken the size of the activities into account. In general the fact that I haven't taken the size of the activities into account must be considered somewhat problematic. This will be discussed at the end of this chapter. Like Figure 2 and Figure 3 were the topic of the previous section Figure 4 and Figure 5 shall be the topic of this section.

Table 2 shows the distribution of talent activities on activity formats.The first thing that becomes clear is that there is a majority of academic Olympiads and competitions. These two formats represent 20 out of the 37 (54 %) activities. Talent classes and online activities are very few in numbers.

The distributions of talent activity types on different formats are very dissimilar (see Figure 4). This supports the validity of making the chosen partition of the activities. Online activities and pull-out activities seem a bit similar by having most talent development activities and fewest interest activities but as there are only three online activities and the difference between interest and talent nurture activities is only one for both formats it might just be a coincidence.

Talent nurture is at least as common as interest activities for all activity formats, whereas talent development can be common or uncommon for a format independently of the other activity types.

10.2.1 *Academic Olympiads*

Georg Mohr is the Danish selection process for the International Mathematics Olympiad (IMO) and other mathematics competitions. School and gymnasium students can participate by taking a test at their own school/gymnasium. If they score high enough in the second round, they are selected for a winners' seminar where they are taught mathematics and are awarded prizes. After this follows fur-

ther rounds until six students are selected for participation in the IMO.

Academic Olympiads seems to be all about talent nurture. In fact only 2 out of the 11 academic Olympiads are not classified as talent nurture (the two mathematical Olympiads) and if we look to the International Math Olympiad (the next step after Georg Mohr) it actually is talent nurture as well. About half of the academic Olympiads are also interest activities and only three out of 11 are talent development.

The lack of talent development in academic Olympiads might seem surprising but perhaps there is a reason for it. The target group for academic Olympiads should already be considered talents as they are chosen for the activity based on how well they perform within a field. Thus the main concern for these students shouldn't be making them better but rather making sure they continue to perform at a high level. This explains why talent nurture is so predominant among these activities and also why half of them are involved in interest activities.

The academic Olympiads are not for the gifted; they are for the gifted and talented. They are not creating new talented students and could be seen as increasing the disparity between the talented and the potentially talented students.

10.2.2 *Competitions*

Unge Forskere is the biggest science project competition in Denmark with 100 projects taking part in the final. Participants send in a project which may then be selected for a regional semi-final and then for the final. The competition accepts projects in the categories life science, physical science and technology. Winners are given monetary prizes and offered participation in other international competitions or events. It is also the Danish selection for the European Union Contest for Young Scientists (EUCYS).

The competitions are split equally on all types of activities. 44 % of them are interest activities, the same goes for talent nurture and again for talent development. One thing which isn't shown by this statistic is that only a third of them have more than one classification and out of those all of them are part talent nurture.

Whereas the academic Olympiads are directed at those who excel in a certain field most of the competitions are directed at students who excel in at least one domain in other words those who are gifted. This can be seen from what is needed to win the competitions. For most of the science competitions the participants need to

be somewhat gifted both intellectually and creatively (sometimes also socially). Simply being talented in an academic field is not enough. You need the good idea which can be developed upon and the ability to present that idea.

The competitions often have aims that are related to improving the competitiveness in the increasingly globalised world, which is also one of the three national reasons for doing talent activities (see Chapter 1 and Section 7.2). With an equal emphasis on all three types of activity the competitions may be in a good position to do just that.

10.2.3 *Online activities*

Khan Academy is a website with a large range of educational videos and tasks within a large range of topics. It is completely free and intended either as a supplement for regular teaching or actual subjects.

With only three activities it is hard to say anything general about this format. All the online activities are talent development and all fall into two types of activities.

The activities here are all formal or semi-formal in their approach that was why I chose them. The Internet is full of sites and videos trying to teach, to inspire or to create networks. I could have included sites such as Quora or Wikipedia, but decided not to, because they focus more on singular information. YouTube is full of channels trying to teach us or inspire us to dive further into specific topics. Channels such as Veritasium and Numberphile are excellent at disseminating scientific principles and should as such be considered interest activities, but I have chosen not to include them here.

The formal or semi-formal online activities I have looked at here are all talent development and international. The two strictly formal activities are also talent nurture because they aim to improve the accessibility of educational provisions in the form of coursework within all kinds of academic fields. The third activity, which is less formal than the others, offers challenges for anyone interested in mathematics (and programming) and encourages participants to develop an enjoyment of mathematics.

Other online activities which have not been included here are less focused in their work on developing the optimal conditions for talent development. They may be doing so, by stimulating the interest in certain fields. The term "online activities" is probably too wide to use for the activities I have included in this format. I think the Internet to some extent represent an entire new platform for doing talent activities rather than just a type of talent activities.

10.2.4 *Leisure activities*

The Danish Youth Association of Sciences (UNF) offers a wide variety of lectures, field trips, workshops and science summer camps primarily directed at gymnasium students. Their activities take place in the four major cities of Denmark and are based on voluntary work from other youngsters. Almost all activities take place at night or during school holidays.

There are no leisure activities focusing on talent development. They mainly focus on talent nurture and a few of them are interest activities. Only one activity is not talent nurture. They are not as numerous as the competitions or the academic Olympiads, but they have more participants than the academic Olympiads and in some cases more than the competitions.

The formats of the leisure activities are very dissimilar. One is a kind of lobby organisation for the gifted, another is a one week camp held every year and yet another is organising small events at a science centre. In spite of all these different formats not a single one of them falls under the category talent development. It seems that perhaps there is an idea that this activity type belongs to the formal education. Participation in leisure activities does not require a certain talent; it may, however, require a certain level of giftedness or motivation. The leisure activities are creating the optimal conditions for the developmental process by picking the gifted and focusing on talent nurture and interest activities, but are leaving the process itself to the educational system.

10.2.5 *Pull-out activities*

Akademiet for Talentfulde Unge (ATU) are actually three organisations operating separately in each their region of Denmark. Gymnasium students are selected for their programme where the students are offered to take part in workshops, lectures, field trips, seminars and other activities. The programme lasts two years and the students are given a certificate at the end.

Only one of the six pull-out activities is not talent development and that is the only one which is an interest activity. Two of the talent development activities are also talent nurture. It should be noted that three of the activities are built up around the same type of activities and are to some extent just local branches of the same activity (Akademiet for Talentfulde Unge (ATU)).

All except one of these activities are talent development. This seems reasonable enough as they are offered to students who don't get sufficiently challenged in their normal education. The extra activities offered by the pull-out activities are various. Some are extra coursework others are camps focusing on a certain topic. The students can often pick activities, which fit their interests, from a variety of activities. This makes the developmental process more effective and ensures that the available spots are offered to those with an interest in the field, who are more likely to become talents.

If we compare the pull-out activities to the leisure activities it is interesting to see how they seem to take completely opposite views of the role of the schools. Leisure activities, as described in the previous subsection push the developmental process to the schools whereas pull-out activities pull the students out of the schools to offer them developmental processes. Perhaps this shows that the leisure activities should be less afraid of having talent development as their aim, seeing as the pull-out activities are showing that the developmental process can take place outside of the school.

10.2.6 *Talent classes*

EduTechLab is a project at Antvorskov School where students are taught using technology such as 3D printers, QR-codes and LEGO robots. They aim to develop all the students' talents by advancing their competencies in the technology of the future. One of their methods is something called challenge based learning.

All three of these activities are only talent development.

This format of activities could be renamed and then expanded to include all activities organised by a school with the aim of doing some talent related activity. Most of these activities are, as mentioned earlier, unfortunately very hard to find, as they are not made publicly known (see Section 9.1). Since all gymnasiums in Denmark are required to offer some sort of activities for what is called "students with special talents" (Undervisningsministeriet, 2013b, § 97) there should be quite a few school organised activities not included.

The two biotech classes are clearly talent development as they are focused on improving the students' competencies within the field of biotechnology. The students must be motivated to be enrolled in the classes, so there is not a need to create an interest in the field only to maintain it. The students are expected to be an active part of the class and may as such become members of a social network of people with similar interests creating an optimal social milieu for the developmental process, which is then the central activity for these two activities.

The last activity, EduTechLab, is not organised as a single class but rather as activities taking place in all classes of a school. These activities focus on using new technology in the teaching. It recognises a potential in all the students for becoming talented and tries to accommodate this potential by using various teaching methods. The focus is on making the students active in and more aware of their learning process.

Activities of this format which are similar to the two biotech classes can probably make do with a lesser focus on being an interest activity than activities similar to EduTechLab, where the students aren't chosen based on their motivation. This means that interest activities cannot be ruled out as a relevant activity type for this format Due to the formal format of talent classes interest activity will probably only be relevant as an overlapping activity type.

10.3 GENERAL ASPECTS

Up until now I have only made one type or format of activity the focus of the current subsection, but in doing so some more general aspects have been missed. These will be discussed in this section.

10.3.1 *Relative size of activities*

The talent activities vary a lot in size. This year there were 100 projects in the final of the Unge Forskere competition while only 28 students will begin in the new biotech class at Ordrup School this year. The differences in size of the activities are not based on the need for them but on practical aspects such as money, time and classroom sizes. A large portion of the money for talent activities in Denmark comes from private funding. Especially the biotech companies seem to be heavy funders, but also the Danish Universities, the Danish Industry Foundation, Danfoss and other Danish tech companies are funding talent activities. The most well funded activities are without a doubt the competitions. The Unge Forskere competition has the largest budget of all talent activities in Denmark. A lot of the funding seems to be based on publicity for the companies towards the possible future workforce and the general public. In this way the funders seem to be focusing on the first reason for talent development, that we need more innovation to succeed in the increasingly globalised world (see Chapter 1 and Section 7.2).

The academic Olympiads in contrast to the competitions are only well funded when the international version is held in Denmark as it was done last year with both the Physics and Philosophy Olympiads. This of course affects the number of participants chosen for the later stages of the Olympiads. Some activities are probably also easier to

find funding for, maybe that is why there has yet to be a Danish version of the Linguistics Olympiad.

Funding is probably a good indicator for the size of talent activities. Whether or not it is also a good indicator of the effectiveness of the activity probably depend on the format and type of activity.

How does the relative size of the activities influence the effective distribution of effect of talent activity types? That is a hard question. To answer it we would need to know how effective each activity is. But that wouldn't be enough since each activity work within a certain set of domains and fields and the participants don't participate in all activities within their domain or field. As such this study can only be used to identify blank spots in the talent activities and trends in the distribution of activity types and formats.

10.3.2 *Relations between activities*

At the final of this year's Unge Forskere competition two leisure activities, one academic Olympiad, almost all pull-out activities and two talent classes were present in some way. This is a clear example of how interrelated all these activities are.

Many participants in talent activities take part in more than just one activity. A requirement from the activity Akademiet for Talentfulde Unge (ATU) is in fact to also take part in a summer school during the two year period the students are participating in ATU. As quite a few students are involved in more activities it is hard to determine how many different students are actually involved. The overlap of participants between activities of course means that fewer students take part in talent activities than possible, but it also means that those who do take part on average must take part in more activities and probably activities of various type and format.

For the individual participant it is of course positive that he or she gets the option of taking part in more talent activities if the activity type fits his or her needs. On the other hand that participant may fill the spot of another gifted student who does not take part in any other activities. Which is the better situation depends on the activity and the needs of the students and is probably impossible to tell in advance.

Quite a few of the activities work together on some of their projects. It might be interesting to see what they gain on these collaborations, that is what kind of symbiotic character the collaborations have. Perhaps this will be included in the evaluation of ScienceTalenter, seeing as they often partake in these collaborations.

10.3.3 *Domains and fields*

It is clear from simply looking at the names of the individual academic Olympiads that they are not aimed at gifted students within certain domains but rather at talents in a specific field e.g. physics, mathematics or biology. The competitions on the other hand focus to a large extent on domains and their subdomains such as inventiveness, persuasion and intelligence. Some specific competencies in fields are, however, still needed for the competitions. Interest activities are as far as I can tell always directed at fields, which makes sense seeing as a certain field should be the end goal if they are trying to motivate the participants to become talents. The competitions which are also interest activities try to stimulate the interest in a certain field and targets participants which are gifted in relevant domains for that field.

Not all talent activities are directed at specific fields. The organisation Gifted Children, which is a talent nurture activity, is directed at providing the optimal conditions for developing any kind of talent but only take in members who are intellectually gifted. Quite a few talent activities make do with leading their participants in the direction of more general fields such as science and technology or business.

In general the talent activities should be taking in participants which are gifted in the relevant domains for the fields that the activities are directed at. In many cases, however, they take a high level of competence in the field they are directed at as a requirement and thus leave the initial developmental process up to the gifted students. This keeps the talents competent but leaves the gifted on their own.

For some activities this should be a concern, but for others it shouldn't. The academic Olympiads have a format which requires the participants to be talents and not just gifted. The format of pull-out activities is usually so that one would expect them to target the gifted rather than the talented.

10.3.4 *Variety of provisions*

In Chapter 5 seven types of provisions were mentioned, which should be available in every school according to Montgomery (2006). These were differentiated teaching, grouping of students, clubs and societies, mentoring, extension and enrichment, acceleration and distance learning. The talent activities I have looked at primarily belong to clubs and societies (e.g. Experimentarium Science Klub and Gifted Children), extension and enrichment (e.g. Talent med Bredde and Akademiet for Talentfulde Unge) and distance learning (e.g. Coursera and Khan Academy). Most of the activities at schools which I haven't been able to find I presume are in the clubs and societies

provision, based on what I have heard from teachers. Differentiated teaching and grouping of students are supposed to be the standard at all schools in Denmark (Rasmussen, 2010a). Acceleration as mentioned in Chapter 5 is rarely used in Denmark. Mentoring is starting to appear at Danish Universities and gymnasiums and the mandatory student plans in the schools can be seen as a form of mentoring, when used properly.

Whether the students are aware of the variety of provisions, which are available to them, is doubtful. This is probably where an increased focus on mentoring could be effective.

Acceleration seems to be somewhat controversial in Denmark. Gross (2006b) and Lubinski et al. (2001) have found it to have a positive effect, but they looked at students with an IQ above 160 which only 1 in 15.000 have. Freeman (2006) studied students of IQ 130 (1 in 20) and above and came to the opposite conclusion. Freeman (2006) admittedly looked at much fewer students than Gross (2006b) and Lubinski et al. (2001) but perhaps the effect only kicks in at very high IQ values. If that is the case it seems like a lot of work to look for the very few who would gain from being accelerated.

10.3.5 *Activity over aim?*

What came first the activity or the aim? In many cases for the talent activities it seems to have been the activity and this affects the aim. If you are aiming at "promoting international contacts in chemistry" an International Chemistry Olympiad might not be the first idea that comes into your mind, but if you want to create an International Chemistry Olympiad you might decide on that to be the aim of it. During the International Chemistry Olympiad there is, however, a cultural and social program which makes sure the activity lives up to the aim.

There is probably a reason why there are so many academic Olympiads and competitions. It is easy to come up with the idea of making a Geography Olympiad if there are already Physics, Chemistry and Mathematics Olympiads. Whether there is a need for one is less obvious, but the geographers will probably think so. Competitions are like the Olympiads easy to come up with the idea for, whereas the aims may seem less obvious. Other activities clearly stem from a need, such as Gifted Children, ScienceTalenter and Nø(r)dskole. These activities usually utilise a wide variety of means to reach their aims.

In the next part of this thesis I'll look at how the activity and the aim of one of the talent classes developed during the startup period.

11 CONCLUSION

In this chapter I will summarise the conclusions which can be made based on the analysis of the previous chapter. This will be followed by a few recommendations regarding future talent activities and perspectives for the future of talent activities.

11.1 ACTIVITY TYPES

All three activity types are covered by at least 13 activities in Denmark. There are many activities which fall under more than one activity type. Talent nurture is the most numerous activity type with 21 activities. Talent development has the fewest overlaps compared to the number of activities.

In the following subsections I will make some conclusions on the specific activity types based on the descriptions and discussions from the previous chapter.

11.1.1 *Interest activities*

Pull-out activities and talent classes are scarcely represented under interest activities. This might show a potential for new activities, such as pull-out activities which focus on awareness, motivation or volition.

As activity type they do not work towards one specific of the three reasons for doing talent activities (see Chapter 1), but may fulfil all of them.

11.1.2 *Talent nurture*

Talent nurture activities focus on creating social networks among participants. This works toward the third reason for doing talent activities, but against the second in some cases. Whether or not the social networks last past the activities themselves is unknown. Neither do we know if some of them turn into professional relations, which in some cases is the aim. The focus on social networks may be spurred by the participants' status as social outsiders.

A few activities focus on increasing the availability of provisions for the gifted or talented. Some activities can be said to change aspects of the social milieu for participants, but the other aspects of the participants' milieu are largely untouched.

11.1.3 *Talent development*

The most formal activity formats are the most common talent development activities. The developmental process takes a lot of time in the form of deliberate practice. This could possibly also take place in less formal activities, but there are currently very few of these which offer long term activities.

Talent development activities often work towards fulfilling the need for talents in an increasingly globalised world specifically, which is the first reason for doing talent activities (see Chapter 1).

11.2 ACTIVITY FORMATS

The distribution of activity types on formats shows a general dissimilarity between all activity formats. The number of activities of different formats shows a dominance of competitive activity formats, but hides a large selection of informal interest activities among the online activities and possibly quite a few undescribed activities restricted to certain schools.

In the following I will shortly conclude on what can be said about the different kinds of activity formats.

11.2.1 *Academic Olympiads*

The target group for these activities are already talents. The activities usually aim at creating a social network among the participants, which can later become professional networks when they become professionally engaged with the field. Some academic Olympiads also have an increased interest in the field as an aim. This increased interest should probably be seen as a professional interest, meaning that the activities aim at attracting and keeping future experts in the field.

11.2.2 *Competitions*

The target group for competitions is usually gifted students. Being creative and able to present ideas are valued traits but also having a high intellect is useful. Many competitions have an entrepreneurial aspect or at least focus on application, which make them very potent in relation to creating talents which are geared for the globalised world i.e. fulfilling the first reason for doing talent activities (see Chapter 1). The competitions are spread evenly over all three activity types.

11.2.3 *Online activities*

Only formal and semi-formal activities have been included here leaving out a large amount of informal activities which are typically aimed at creating interest or fascination of fields. The two formal activities aim at offering free high quality education to everyone. The semi-formal activity is an interest activity with a focus on developing a mathematical talent.

The Internet may be considered to represent an entire new platform for talent activities of many formats.

11.2.4 *Leisure activities*

The only things leisure activities have in common are that they take place in the participants' leisure time and that none of them have talent development as their aim. A suggested reason for the latter is that they see the formal education, in the form of the educational system, as the place where talent development should take place. Instead they focus on creating the optimal conditions for this development to take place.

With the large focus on improving the conditions for the potential talents it seems that leisure activities are very interested in increasing the wellbeing of the potential talents in other words working towards the third reason for doing talent activities.

11.2.5 *Pull-out activities*

These activities have an opposing view to the one suggested for the leisure activities. Pull-out activities have talent development as their aim (except for one activity) and pull the participants out of their place in the educational system for a limited period of time to develop a certain talent.

These activities are working from all sorts of motivation pointing them towards all three reasons for doing talent activities often in a more focused manner than other activity formats.

11.2.6 *Talent classes*

The activities I have included under this activity format are all talent development activities. I put an emphasis on included because I know that there are a lot of activities which haven't been included here because I haven't got sufficient or any information on them. What activity type they fall under remains unknown.

These activities were initiated with different original purposes, but all aim at developing talents among their students. Depending on how the activities choose their participants they can justify different

levels of focus on the intrapersonal and environmental catalysts. The activities are all long term a trait which is rare among the other activity formats, but greatly advised.

Of the three activities I have found two of them are effectively working against the second reason for doing talent activities (the contagiousness of talent) by herding the potential talents into one class. They do, however, all seem much focused on creating talents which can stand the challenges of the globalised world, i.e. the first reason for doing talent activities.

11.3 GENERAL CONCLUSIONS

The following conclusions are not related to a specific activity format or type but rather general aspects of talent activities.

11.3.1 *Relative size of activities*

Funding seems to be decisive for the size and even existence of talent activities. In this way the sponsors of talent activities have a great influence on what is seen as a useful talent. How much of an influence on effectiveness of the activities funding has is unclear.

The influence of sponsors, primarily being companies, on talent activities probably increases the focus on creating talents which are useful for the companies thus improving their competitiveness in the globalised world. This again means that the focus is on the first reason for doing talent activities.

11.3.2 *Relations between activities*

Many activities interact with each other across formats. The same goes for their participants, which means that they might experience all kinds of activity types. The symbiotic character of the interactions between activities is unknown.

11.3.3 *Domains and fields*

Activities tend to focus on fields rather than domains. Academic Olympiads are all focused on a field while competitions tend to require giftedness in some domains, but are still directed at fields. Interest activities are usually directed at broader fields in their individual activities.

In the selection process for activities of all formats a high level of competence in specific fields is often required. This is problematic for the gifted who are unable to initiate their developmental process.

11.3.4 *Variety of provisions*

Montgomery (2006) suggested seven types of provisions for gifted education which should be available at all schools. Differentiated teaching and grouping of students are supposed to already be integrated in the schools. Acceleration is not common in Denmark and may not be advisable for more than a very few students. Most of the activities I have looked at are clubs and societies, extension and enrichment and distance learning. The last provision is mentoring, which is starting to appear in some places and as parts of some activities. Mentoring could be a useful tool to make gifted students aware of other available provisions.

11.3.5 *Activity over aim?*

A lot of activities seem to originate from a desire to make a certain activity rather than to achieve the aims they set for themselves. Those activities that originate in an aim usually utilise a wider variety of means to reach their aims.

11.4 RECOMMENDATIONS

Based on what have been uncovered in the discussion and summarised here in the conclusion I have come up with a few recommendations for what could be done to improve the talent activities in Denmark. I have organised the recommendations into those that concern the content of the activities and those that concern the choice of participants.

11.4.1 *Content of activities*

I have not looked at actual content of activities, but base the following recommendations on what the aims and the short descriptions of the activities I have found imply about the content.

In general a greater focus on creating content that advances the aims of the activities is recommended. Many activities seem to focus on more practical aspects and sometimes even tend to forget about their aims (or even defining them). A good place to start is to always ask "why are we doing this?"

The pull-out activities have shown that talent development doesn't have to take place inside the educational system. This means that leisure activities could have talent development as their aim contrary to what they have at the moment. An example of an activity of that kind would be a science club where members are able to explore a field of their interest to a greater depth than what is possible at their school on a regular basis.

Activities which focus on creating relations between their participants should not limit this to a social programme or expect it to happen automatically from having one. It might also be a good idea to provide some sort of opportunity for participants to interact after their participation ends. A simple thing such as a list of participants with a little extra information could be helpful for them to reconnect later.

11.4.2 *Choice of participants*

Based on which of the three reasons for doing talent activities in Denmark an activity works toward they may want to choose different kinds of participants.

If they are focused on the globalisation issues of talent activities they should probably choose participants which have a good chance at becoming successful at driving the economy forwards by innovation or by creating new business opportunities.

If they aim at developing talented students which can raise the level of their peers, the "contagious" argument, then it might be a good idea to choose participants which have a good chance at influencing their peers. This would often be some of the popular students in the class rather than one of the social outsiders. The peers will only gain a higher level if they are motivated to do so and a higher motivation is easier achieved by making it popular to be at that level.

If the social well-being of the gifted or talented students is the aim of the activity the participants chosen for the activity should naturally be those gifted or talented students who fail to thrive in their environment.

11.5 PERSPECTIVES

"A systematic strategy for talent development at all levels of the educational system is needed." This was probably the most central conclusion from the "Talentrapport" (Hermann et al., 2011). The centre for this strategy was supposed to be changes in the structure and rules of the educations. Whether the reform of the schools in Denmark, which is going to be implemented in the coming year or the future gymnasium reform, is going to be this change is uncertain. The first of three overall goals of the school reform is for the school to challenge all students, so that they become as proficient as possible (Undervisningsministeriet, 2013a). This was also a goal of the former school as reported in the chapter on gifted education in part 1. The only specific mentioning of talent in the reform is about the possibility of talent classes in the fields of music and physical education.

We know that for talent activities to be the most effective they must be long term oriented (Heller, 2005). It takes a lot of time, practice

and involvement to become a talent no matter how gifted you are. Talent classes are apparently the means in the fields of music and physical education, so perhaps it should also be in science?

In September 2013 I was approached by representatives from Ordrup School. They told me about a new talent class in the field of biotechnology, which they were about to start and asked if I would be interested in studying it. I decided to take them up on the offer and chose to focus on the process of creating this activity and how the image of the potential students developed along with it. That is what the next part is about.

Part III

THE 5-YEAR BIOTECH PROGRAMME IN ORDRUP

12

OVERVIEW OF THE PROCESS

12.1 WHAT'S IT ALL ABOUT?

Last year I got an exceptional opportunity. I was offered to follow a talent activity before it actually existed. I was offered to follow it during the period where the details of the format, content and participants were decided.

The activity I'm referring to is the biotech class at Ordrup School and Ordrup Gymnasium; a talent class that welcomes its first students this year, following a one year long period of activity development.

This part of the thesis is about how the biotech class developed as an activity during the year I have followed it. In particular it is about how the people involved in the planning of this activity changed or kept their views of what a talented student is and how the biotech class should accommodate that kind of students. It is also about how the biotech class evolved as an activity into the format and content it now is planned to have.

There are several other aspects of the biotech class which could have been of great interest to take a closer look at. Most significantly are probably the issues of the transition from school to gymnasium and from one school to another. Since the focus of this thesis is on talent development these aspects have not been studied here even though they formed central discussions among the teachers and in the developmental process of the biotech class.

12.2 ABOUT THE BIOTECH CLASS

The biotech class is a five years long STX programme organised in collaboration between Ordrup School and Ordrup Gymnasium. The students enrol when they were otherwise supposed to start in the eighth grade. The first two years of the programme take place at Ordrup School and in some lessons at Ordrup Gymnasium. The last three years take place at Ordrup Gymnasium. The class will have biotechnology as their specialised study subject ("studieretningsfag" in Danish) at Ordrup Gymnasium. In this way they are not accelerated through the educational system. Instead they are supposed to end up with a deeper understanding of what they have learned and with more subjects than in a normal STX programme.

This was more or less the description of the biotech class when I started following it. They had been granted permission from the

ministry of education to create this special class since they needed to break with the normal procedure for admitting students to an STX programme.

In the period where I followed the project the details of how the students should be taught were developed and students were chosen for the first year.

12.3 THE PROCESS

The first time I heard of the biotech class in Ordrup was at the first Nordic Talent Conference in Sorø in 2013. Following this I met with the project leader to decide whether or not to study it. After I had decided to do so I attended some meetings where some of the content was decided upon. In the spring of 2014 a brochure was send out to all families to whom the biotech class was relevant and shortly thereafter an information event was held which I attended. After this the potential students were encouraged to submit an application to join the class. Before Ordrup School and Ordrup Gymnasium decided who to admit to the class I had an interview with the project leader about what defined the kind of students they intended for the class. After they had chosen the students I had a similar interview with the project leader again asking him to describe the ideal student for the class and the students they had chosen for it.

In this part of the thesis I will describe what I learned about how the students in a talent class such as the one in Ordrup are perceived and how this perception may have evolved.

13 THEORY

13.1 IMPLIED STUDENTS

As a tool for studying how the people involved with the biotech class in Ordrup changed or kept their views of what a talented student is and how the biotech class should accommodate that kind of students I have chosen to use Lars Ulriksen's concept of implied students (Ulriksen, 2009). This section will introduce what the implied student is and how the implied students are identified.

13.1.1 *What is the implied student?*

What type of student does it take to complete a study successfully? What characteristic traits and behaviour should a student have and follow to fit in with the other students and what should he or she be doing while studying? All of this can be said to be described by the concept of the implied student. Ulriksen (2009) defines the implied student as "the study practice, the attitudes, interpretations and behaviour of the student, that is presupposed by the way the study is organised, the mode of teaching and assessment, by the teachers and in the relations between the students enabling the students to actualise the study in a meaningful way" (Ulriksen, 2009, p. 522).

The implied student is a description of the type of student that fits the study. It is called the implied student because you cannot necessarily read what type of student it is. The description often lies hidden in the situations; it is implied by the social context. Ulriksen (2009) gives an example from Hasse (2002) where a group of boys studying physics play with some wheels and make thought experiments about dropping them from the Eifel Tower instead of making the measurements and exercises they are supposed to. In doing so it turns out that not following the intended study plan, i.e. making the measurements, is okay. In fact the playful expansion of the experiments is seen as a highly positive thing by the teacher and not at all discouraged. Hasse interpreted this as a high regard for the "spirit of the researcher" (Hasse, 2002, p. 156), a behaviour which is then a part of the description of the implied student. The implied student is a dual structure according to Ulriksen (2009, p. 522). Firstly it is a structure in the study how it is designed, which methods of teaching are being used and what the culture among the students is like. This can be expressed by the teachers in their expectations towards the students and how the students mutually define the culture amongst

them. Secondly it is the structure of what the students can do in the setting of the study, what is acceptable behaviour both in class and out of class.

Ulriksen (2009) points to the possibility that a study can accommodate more than one implied student, showing that there is not just one correct way of doing the study, but possibly multiple.

13.1.2 *Identifying the implied student*

The implied student is hidden in the teachers' expectation to how the students will react to certain situations, how the classroom is organised, how the students interact and many other aspects of the daily life of the students. So how do we identify the implied student? There are many ways of doing so and they can all be used to identify different aspects of the implied student. One way is to look at how the teachers articulate their expectations to the students' progress and the effectiveness of their own teaching methods. Another is to look at which students are being used as the prime examples of a good student and which are not. It can also be to simply observe how the students interact amongst each other, with the teacher and what other actors may be involved with the study.

Each new method of looking at the implied student of a study can reveal new aspects. Since there were no real students for the most part of my study I have instead focused on how the organisers talked about their expectations for the future students and what type of students the type of study they were organising would accommodate. I'll explain more on this in the next chapter.

14 METHOD

In my study of the biotech class in Ordrup I have chosen to take a few different approaches. My primary method for a long time was to simply observe all the organisational meetings they had. Shortly before the first students were chosen I decided to do an interview with the project leader, to get a clearer idea of his expectations for the future students. I also did a similar interview with the project leader shortly after the students had been chosen to figure out what might have changed upon meeting the actual potential and future students. All of the observations and interviews were sound recorded but only short parts of them were transcribed.

This chapter will explain why I chose to use these methods and how I used them.

14.1 TIMELINE

The biotech class has been underway for quite some time. In Figure 6 I have summarised all activity related to the class that I am aware of. Green activities indicate that they have been included in the analysis for this thesis. Blue activities are those I attended but did not include in the analysis. The red markers indicate deadlines or events connected to the biotech class and the purple bars at the bottom are extended activities (which I did not attend). In the next sections I will shortly describe the activities and my methods related to them.

14.2 EXCLUDED MEETINGS

Two of the activities I attended have not been included in the analysis.

At the first meeting with the project leader I still hadn't decided on following the biotech class. The meeting was mainly information about the project and what had made them decide to make this new class. It was not recorded.

The trans-institutional work day was a day where teachers from Ordrup School and Ordrup Gymnasium met to figure out how their subjects should work together between the two institutions and between subjects at the same institution. It began with a short presentation of the work done at DTU by EduForce and Biotech Academy. It was recorded, but due to a lot of group work taking place in changing parts of the room it proved difficult to get recordings of everything.

The first meeting was not included in the analysis because I did not have reliable data from it and the content of the meeting made it less

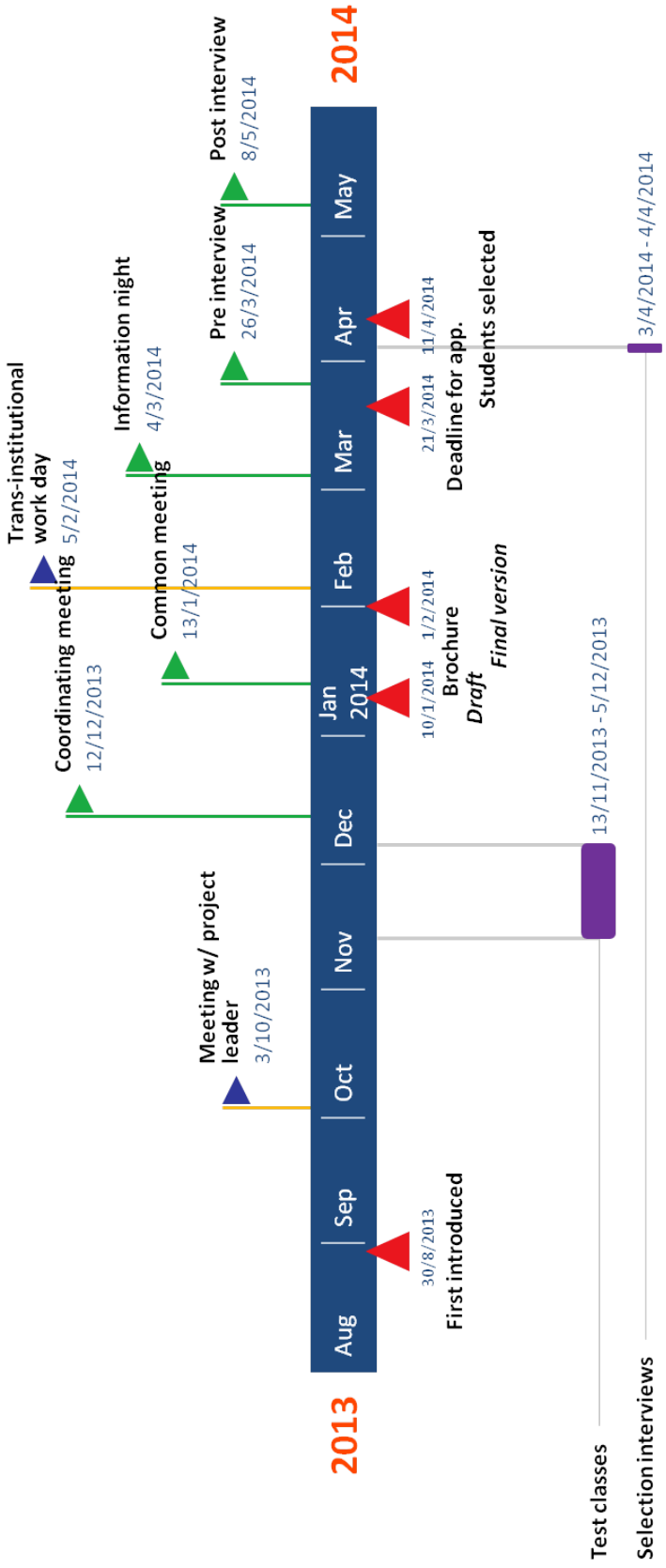

Figure 6: Timeline for the biotech class

useful for the analysis. The trans-institutional work day was not included either. Many of the participants at this activity had very little involvement or influence on the project, they were there because they had practical experience with teaching the subjects and possibly had ideas for how they could work together. At the post interview I was told by the project leader that the trans-institutional work day had been pushed aside. Due to both of these aspects combined with the extensive amount of work which would have been needed to analyse the work day I have decided to exclude it from my analysis.

The effect of excluding these two activities I hope is minimal. There may have been aspects from the first meeting that could have given an even earlier image of the implied students than the other meetings, but unfortunately this was not possible. The trans-institutional work day could have given an image of the implied students according to the influential people who did attend the work day if I had analysed only their comments during the day. Due to time constraints and a weighing of the possible outcome of the amount of work needed I decided not to follow up on this. This means that the work day has an unknown influence on the implied students, but as the work from this day is not being used it seems reasonable that it has less of an influence than would have been expected.

14.3 OBSERVATIONS

During the study I acted as an observer at two meetings, the trans-institutional work day and the information night. In this section I will describe why I chose to use observations like these in my study and what I did during these observations.

14.3.1 *Why use observations?*

With observations you don't get straight answers to your questions, because you don't ask questions. You have very little influence on what is being said and done and yet still your presence might affect what is going on making the situation less objective. So why did I choose to use observations in my study?

By observing a meeting you hear how people talk about a topic you don't just hear what they think of it as you would have done if you asked them. It is not as fast a process as the interview but it can be much more revealing, especially because the observed might start discussing the topic from an angle you didn't think of or maybe even knew existed.

Seeing as I have been trying to get an idea of who the implied students for the biotech class were during the initiation of the class it was particularly interesting to hear what the teachers thought was the aim of the class and what kind of students would be in it as

this would be a description of the implied students. That was why I observed of the organisational meetings.

14.3.2 *Observational method*

The most objective observation is obtained if those being observed don't know they are being observed, but it is very rare you get permission to do that kind of observations (and it's hardly morally defensible).

I was allowed to sit in and observe what was going on during the organisational meetings of the initiation of the talent class in Ordrup. During these meetings I would sit at the end of one of the long sides of the table used for the meetings. On the table I had an audio recorder clearly visible and everyone in the room had given their consent to me using it. I also had a notepad where I would occasionally write short sentences. During the meetings I only spoke when spoken to. When they spoke to me, which rarely happened, I tried to answer the questions as well as I could but also to be brief and not say too much about my own ideas. My position at the table was chosen to attract as little attention as possible. It was as far away as possible from the project leader and the door. From this position I also had a good view of what was going on and could easily hear everyone. My position didn't seem odd to anyone as some of them would sit next to me or opposite me. At the beginning of the meetings there were five or seven other people than me in the room and in the second half there would be three or four. The audio recorder was not unfamiliar to the teachers as some of them had used one themselves when they had written their bachelor thesis and I think they completely forgot about it a few minutes into the meeting. Everyone at the table had a notepad and would write things down occasionally so this didn't seem out of place and the things I wrote were never specific to a person but just general aspects to remember.

I had decided to speak as little as possible during the meetings on one hand because it would seem out of place for me to be talking during the meeting and on the other hand because I didn't want to interfere with their process. Most of the times when I spoke during the meetings, it was to explain what my project was about or if they needed help finding a specific term for something related to biology.

All in all I think my presence had very little influence on what happened during the meetings.

14.4 INTERVIEWS

Observations are good for some types of qualitative studies but in other cases interviews are a better choice of method. After all the meetings had taken place I thought I might gain some extra knowl-

edge about the project from interviewing the project leader so I decided to do this shortly before the interviews with the potential students and shortly after the interviews.

In this section I will describe the interviewing method I used and why interviews could be useful for this kind of study.

14.4.1 *Why use interviews?*

When you interview a person the answers you are getting will ultimately be a reflection of the way you are asking and what you are asking. The answers are, however, still a more or less straight answer to your question, which means that you don't have to sit and observe a person until he or she coincidentally tells you the answer to an unspoken question.

When I decided to make the interviews with the project leader there were no more meetings which I could sit through and observe so as such my data collection would have ended there if I didn't choose to make an interview. I still had a few unanswered questions about his thoughts on the implied student of the biotech class, so it seemed the right thing to do.

14.4.2 *Interview method*

Kvale and Brinkmann (2009, p. 353) defines a semi structured interview as "a planned and flexible interview, with the aim of collecting descriptions of the interviewee's lifeworld to interpret the meaning of the described phenomena" (my translation). This is exactly what my interviews were. I had an interview protocol for the interviews, which is a list of planned questions to ask during the interview, which I got through but in a flexible manner by asking the questions as part of a conversation without jumping too much between topics.

The pre interview was very much like a conversation in its form especially because the project leader also asked me a lot of questions about what I perceived as the characteristics of the students they were looking for. I decided to agree to this form even though it made me highly influential on the further process, because it more or less had been an underlying agreement from the beginning of my study that I would also help them in determining some of these characteristics. My comments, however, always came after the project leader had given his comments on the topics of the conversation. The interview was a sort of conceptual interview (Kvale and Brinkmann, 2009, p. 171) where I tried to uncover the project leader's idea of what kind of students they were looking for (while also uncovering mine).

My interview protocol for the pre interview focused on getting a description of the implied students for the biotech class in a direct manner. This meant that one of my first questions was for the project

leader to describe the intended future students. After that he asked me a similar question for which I had prepared a description of my impressions of the implied students. When giving him this description I made sure to hear if he agreed or disagreed. In this way I got confirmation of many of my assumptions about the implied students, an important aspect for the constructivist approach I have taken to this study (see the last section of this chapter). Apart from these topics the interview protocol also contained a few questions about the selection process and the format of the acceleration and enrichment.

At the post interview I chose to focus on a more narrative style of interviewing (Kvale and Brinkmann, 2009, p. 173), where I asked him to recount what had happened since our last meeting and how they had chosen the students. This was done to not only get the criteria for their selection process but to also get some information as to how they did it and what their experience of the potential students had made them realise about the project.

The interview protocol for the post interview differed from the pre interview by the narrative style but also by focusing on actual students. This was my first and only chance of having the project leader describe his impressions of the selected students and at the same time describe the implied students. This was particularly useful because it could show whether the two aligned and in which way they did so.

14.5 TRANSCRIPTION AND ANALYSIS

A transcription is a written word for word account of what was said (and sometimes done) during a period of time. It is often used for analysing interviews.

This section is about what I have chosen to transcribe, why I have chosen to do so and how I have done it. It is also about the method of analysis of the implied students, which the process of transcribing became an integrated part of.

14.5.1 *What should be transcribed?*

I have not transcribed every part of my observations and interviews. I have chosen not to do so because I am not interested in everything that was being said during my observations and interviews. It is not relevant to hear how the teachers discuss how different topics are related between the subjects, but it is relevant to hear those few sentences where they decide that the biotech students should be good at interdisciplinary work. That is why I have decided to only transcribe short parts of my observations and interviews for closer analysis and for use as citations.

This does not mean that the discussions among the teachers about topics between subjects are irrelevant. They are highly relevant as

they tell about how the teachers intend the students to understand the interrelations between subjects. Instead of transcribing these discussions I have taken notes of what the discussions tell about the implied students and when they occur. These notes have then been used for making the analysis in the next chapter. This can be justified because the focus hasn't been on the linguistic nuances of what was being said, but rather on the intentional content of the words.

Due to an agreement of confidentiality I am not able to release an audio version of the observations and interviews.

14.5.2 *Method of analysis*

For my analysis of the implied students of the biotech class I have used an iterative process for identifying useful descriptions, comments and sentences from my observations and interviews. First I have listened through all of my recordings while noting timestamps for moments which could be useful for the analysis. After this I listened to the moments given by the timestamps again to figure out what aspects of the implied students each moment was describing. This gave me a long list of citations, notes and comments about the implied students from all observations and interviews. The next step was to organise each time stamped citation, note and comment into groups based on their topic for each recording. After this I had a list of topics for each recording and relevant references for each topic describing what had been said in relation to this topic at each observation and interview. This was a very useful method for being able to compare topics between observations and interviews.

I have not included the written brochure about the biotech class in the analysis. The draft of the brochure was produced the night before the common meeting so the contents of it is probably reflected in that meeting. The final version was an updated version of the draft edited by the municipal administration and as such does not contain any updated information just a new wording chosen by people with no connection to the actual programme.

14.6 PHILOSOPHICAL PERSPECTIVES

My approach to studying the biotech class has been that of a naturalistic inquiry. In this section I will describe some of the philosophical perspectives that arise from this approach.

14.6.1 *Naturalistic inquiry*

Naturalistic inquiry, as opposed to conventional inquiry, takes a phenomenological approach rather than a positivist approach to how meaning occur (Guba, 1978). This means that where the positivist

seeks causes for or facts about social phenomena which can be generalised, the phenomenologist seeks to understand the occurrence of social phenomena in the frame of reference of those individuals involved. The positivist seeks generalisable facts whereas the phenomenologist seeks correlations.

This is the first of fourteen traits of naturalistic inquiry described by Guba (1978). Other traits include how the naturalistic inquiry is a process of discovery rather than verification in that the inquirer is immersed into the phenomena with as open a mind as possible. Yet the inquirer does not become a manager of the situation but rather a spectator.

The naturalistic inquirer takes a social constructivist approach to reality. It is often the case that the reality the naturalistic inquirer is studying only exists in the minds of individual people. As each individual have their own perception of the reality the naturalistic inquirer must deal with a reality manifold which is constantly changing due to the interactions between the individuals. For this study the implied students represent this manifold in the minds of the teachers and other stakeholders.

One of the challenges of defining this manifold, here represented by the implied students, lies in the naturalistic inquirer's strive for confirmability. Confirmability is the agreement among a variety of information sources (Guba, 1978). In other words the naturalistic inquirer strives for finding aspects of the reality manifold common to a group of informants.

14.6.2 *Criteria for constructivism*

Confirmability is a well known criterion from social constructivism. Denzin and Lincoln (2005) puts it among trustworthiness, credibility and transferability as the criteria for constructivism and points to how they are the usual replacements for the positivists' criteria of internal and external validity, reliability and objectivity.

Of the remaining criteria I see no reason why the trustworthiness and credibility of the informants should be doubted in this study. When it comes to transferability it is interesting to think of how this study focuses on a project which is in fact to a large degree a copy of a similar project at the private school Bagkost approximately ten kilometres to the west. A perspective of this study could be to look at the transferability between these two programmes. Looking at the biotech class from a more general perspective, however, it does seem reasonable to assume a high degree of transferability to other talent activities as they share the same educational context. Whether this is a sufficient factor for sharing a common paradigm of talent and giftedness is doubtful, but there are probably great overlaps.

15 RESULTS

During my observations and interviews I searched for changes in the description of the implied students of the biotech class. In this chapter I will give a description of the most significant changes I found, when they happened and what may have caused them.

I have organised the changes into six categories, which I will describe and analyse in the following. After that I will give a short summary of the changes and shortly describe other aspects of the implied student that remained constant throughout my involvement with the biotech class. The descriptions take a chronological approach to the changes by looking at the observations and interviews in the order they happened. The descriptions are followed by an analysis of the changes and the content of the categories.

15.1 MOTIVATED OR ACADEMICALLY STRONG

The students chosen for the biotech class must have a talent for biotechnology or the interest for building one. This is a multiply repeated statement, which occurs in the information material about the biotech class (Ordrup Skole and Ordrup Gymnasium, 2014), during the meetings I observed and during the interviews. The two options are, however, not equally potent in the selection process or in the opinion of the teachers.

In general having a talent for biotechnology can be translated into being academically strong in the science subjects and having an interest for building a talent for biotechnology can be translated into simply being interested in science related topics or motivated for being in the class.

During the first meeting I observed, one of the teachers expressed that the future students should be "talented or interested, probably mostly talented" (0:05:20 Coordinating meeting, my translation). During the second meeting it was made clear by another teacher that if you weren't good at mathematics then you shouldn't be in the class (0:57:30 Common meeting). This shows that having a talent is more important than simply having an interest for building one.

At the information night this seems to start changing. Here it is made clear that it is not a school for nerds, but rather one with a focus on certain areas of interest (0:36:20 Information night). They are still expected to end up with higher grades (1:42:20 Information night) but the most important factor in the selection process is now

"not being an expert but being motivated" (1:36:50 Information night, my translation).

When I interviewed the project leader shortly before they made the selection interviews it was still clear that the students probably were good at most subjects in the school. Motivation was still the greatest factor, but it seemed to be split between two aspects where one was being interested in the science subjects and working dedicated within the fields of biotechnology (0:10:10 and 0:07:20 Pre interview) and the other was being motivated for being in a class where they are challenged and not just motivated for changing class (0:09:40, 0:43:20, 0:43:40 Pre interview). The large number of applicants for the biotech class (49 with only 28 vacant spots) seemed to have led them somewhat back to academic strength as a deciding parameter due to its perceived objectivity but not necessarily as a desired parameter (0:34:50 Pre interview).

After the selection interviews I had an extra interview with the project leader. At this interview he told me that the three criteria they had judged the potential students by were interest in science, potential to complete the programme and desire to take part in a new class (0:01:10 Post interview). None of these say anything about how talented they are but it does put an emphasis on how interested they are in biotechnology. The project leader did, however, now seem more convinced that a test of the students' competencies within some of the relevant subjects should be used in the selection process (0:13:30 and 0:24:20 Post interview). This again may not necessarily be because it is a desired parameter but rather because of the large number of students they had to reject, of which six made formal complaints about the process and its lack of objectivity (0:04:00, 0:12:30 Post interview).

If we look at the initial statement again, that the students chosen for the biotech class must have a talent for biotechnology or the interest for building one, it is clear that the initial interpretation of it was tilting mostly towards the talent part, but later came to lean in the interest/motivation direction as the desired parameter for entry to the biotech class. Yet it seems it might return to talent now that they know they will need a more objective selection process.

If the selection process is changed to include a test it will change the type of students who are selected. A test may be the most objective tool for a selection process, but it is unable to measure any of the three criteria they decided on for this year's selection process i.e. interest in science, potential to complete the programme and desire to take part in a new class. If a test is to have any influence on the selection process it will mean that the students chosen for the biotech class are those with a talent for biotechnology (or whatever is tested for) and not either them or those with an interest for building one. Simply having an interest won't be enough.

The DMGT gives an interesting perspective to this situation. Motivation and interest lies in the intrapersonal catalysts. In Part ii I classified the biotech class as a talent development activity. Assuming the environmental catalysts are present this means that both catalysts and the developmental process is accounted for in this activity, which should then mean that a gifted student chosen for the biotech class based on his or her motivation has the ideal circumstances for developing a talent. If a student, however, is chosen based on a talent and isn't properly motivated, which might be the case if the selection process is based on a test, then he or she will have difficulties in reaching a potential talent in biotechnology. This means that if they decide to use a test for the selection process next year to get a higher level of objectivity, then they should also consider implementing elements in the programme, which increase the motivation and interest for biotechnology.

No matter which direction they choose the students selected for the biotech class should be somewhat gifted according to the DMGT. How giftedness plays into the selection process and in the description of the implied student is described in the next section.

15.2 GIFTED OR TALENTED

The implied students of the biotech class in Ordrup are neither strictly gifted nor strictly talented. During the time I followed the initiation of the biotech class I found that the teachers went back and forth between giftedness and talent often without noticing it. The clearest example of this is from the information night where the principal of Ordrup School mentions the potential students as "children with special competencies, potentials, prerequisites, talents call it whatever you want" (0:36:10 Information night, my translation). In this example the names and characteristics of BMSF and talents are mixed together to form one group of students.

As mentioned in the previous section academic strength or actual talent seems to be a defining characteristic of the implied students for a lot of the time. More than once they are said to be among the top three or four in their respective classes within the relevant subjects (0:02:20 Coordinating meeting and 0:17:00 Pre interview). This puts them at about the top 10 % which is similar to Gagné's definition of talented (Gagné, 2010). There are, however, moments where the picture changes slightly to include the gifted as well and these are not just based on confusion of relevant terms. The students are often characterised as not properly challenged or not situated in an environment that supports their development (0:10:20 Coordinating meeting and 0:19:00 and 0:43:40 Pre interview); characteristics common to gifted students.

After having selected the students for the biotech class the project leader had a few reflections on the process and on who they might have missed in their selection process. In his reflections he states that the children with special prerequisites (BMSF) are probably the most interesting group but also their biggest pitfall in the selection process (0:06:40 Post interview). By this he means that they were the hardest group to identify and in many cases possibly weren't selected for the class.

The biotech class is a talent class. It should also have been a class for the gifted students, but due to the difficulty of identifying the gifted and the confusion about who they actually are the selection process did not favour them.

Gifted children are difficult to identify especially when those you are searching for are multiply gifted. Intellectual giftedness is the major type of giftedness the biotech class is looking for, but also creative and social giftedness seems to be valued in the programme due to their focus on innovation, philosophy and the ability to quickly form a strong social environment in the class. An IQ test won't do the trick. A description of the students from current teachers, which was part of the application, didn't either. A test for multiple intelligences (Gardner and Hatch, 1989) or using the triarchic model (Sternberg, 1985) might be useful, but the question is whether or not it is worth the effort. The selection committee quickly agreed on more than two thirds of the selected students after the interviews and then spent 4 hours deciding on the last ones. The students chosen for the biotech class should not necessarily simply be the most gifted ones they should be the ones with the biggest potential. Based on the works of Duckworth et al. (2007) and Ericsson et al. (1993) it seems reasonable to include motivation and interest as a significant factor in measuring the potential of a student.

I did not observe the selection interviews and have had no contact with the applicants for the biotech class, so I only have the post interview to base my perception of the students on. Based on that I do, however, believe most of the students who applied for the class were qualified for being selected. The process ended up favouring those who could show a motivation for being in the class rather than those who were highly gifted or talented. Whether or not this was the correct way to do it depends on what the organisers think of as being the most important trait and should be decisive for whether or not a test for giftedness or talent should be used next year.

15.3 MATURITY

A typical trait of gifted children which is often mentioned in lists of identifying behaviour is their high level of maturity (cf. Children, n.d.). In this section I will describe how the implied students of the

biotech class seem to be increasingly mature throughout the period I followed the project.

At the coordinating meeting the implied student could be described as a student at the top of his or her class who is able to follow more advanced levels of teaching and can see the connections between the subjects which are taught (0:01:00, 0:38:30, 0:52:40 Coordinating meeting).

At the common meeting the picture was much the same but now the implied student was also one who was aware that he or she should continue into some kind of tertiary education after the program and thus worried about what subjects would be offered at the gymnasium level. The student's interests should be in the science subjects and he or she should be comfortable with a changing schedule and more homework (0:27:40, 1:14:20 1:22:10 Common meeting).

Again at the information night the implied students were described as very mature. They should be asking themselves what a gymnasium exam in biotechnology could be used for and have high expectations on their own behalf. They should be significantly more "studieparat" when they start at the gymnasium, a concept which, in the words of the principal of Ordrup Gymnasium, means that they have better work ethics and are more motivated for taking part in the teaching. Some of this should show itself in the form of a more unified class which can collaborate on improving the academic level of the entire class (0:33:50, 0:46:40, 1:30:00, 1:40:40 Information night).

At the pre interview there were indications of more or less all the previous maturity signs in the implied student, but also a few more. Most noticeably the students should be responsible for their own actions, able to quickly build relations with other students and willing to change away from the class if it doesn't live up to their expectations (0:09:20, 0:09:50, 0:42:50 Pre interview).

At the post interview the implied students were split into two groups based on gender. Apparently the girls were more mature than the boys in general. The girls had more long term goals, were very focused on biotechnology and knew what they wanted. The boys on the other hand were more spread out in their interests and only some knew that they wanted to do something related to biology after the biotech class. Again all the previous maturity traits were indicated in some way throughout the interview (0:37:10, 0:37:50, 0:38:10 Post interview).

At the first two meetings the participants were all teachers from the school. This may be why the description of the implied student more or less corresponds to the ideal gymnasium student, whereas the implied student later turns into a student, who is focused on life after gymnasium, when the gymnasium teachers have had some influence.

It would seem that whenever a teacher describes the maturity of the implied student when first he or she is supposed to teach that student, the student is described by traits characteristic for the ideal student at the completion of the education the teacher is responsible for. In other words the school teacher describes the maturity traits of a gymnasium student and the gymnasium teacher describes the maturity traits of a university student in their view. What they are basically describing is a student at the horizon of their own involvement. This means that they can focus on the content of their subject and don't need to think about other aspects of the students' education

15.4 ACCELERATION

One of the central goals of the biotech class is an accelerated progression (0:57:40 Coordinating meeting). How much and how they should be accelerated as well as what should fill up the extra time is a question which have been discussed at the meetings and seems to have changed over time. In this section I will take a closer look at the acceleration itself and in the next section I will look at what should fill up the extra time.

At the coordinating meeting it seemed that the students are going to be accelerated throughout the programme simply by increasing the pace at which they are taught and by inviting the gymnasium teachers to expand on certain topics early on, e.g. teaching about the unit circle when basic trigonometry is covered in the school (0:16:20 and 0:52:40 Coordinating meeting).

At the common meeting a short remark was given on a joint science exam and it was made clear that the acceleration is not supposed to come from an extra number of teaching hours but rather by compressing the topics into shorter periods of time and by bringing gymnasium material into the school when there are overlaps, so that it doesn't need to be covered later (0:27:40, 0:29:30, 0:29:40, 0:31:20 Common meeting).

As earlier described, motivation seems to take over from academic strength at the information night (see Section 15.1). Here the class was not one that pushes the students to work harder, but rather one where the students are motivated to work harder based on a common interest (0:36:20 Information night). There was no talk about an early examination and it was made clear that it is a class where the students make an effort and train but don't swot (0:35:50, 0:36:20 Information night).

At the pre interview the project leader saw it as very possible that the science subjects of the school could be finished in December during the second year of the programme, that is half a year prior to what is common. There were, however, some difficulties in the formalities of this (0:22:40, 0:24:40 Pre interview). Mathematics could also be

finished at this point but again the formalities of it might obstruct the process (0:26:20 Pre interview). To reach this level the students are supposed to be dedicated and be able to push themselves much further because they only have the same amount of time as the regular classes (0:08:00, 0:10:10, 0:27:20 Pre interview). The project leader brings the teachers back into the acceleration process by saying they should be geared for a different type of teaching and be able to see beyond their own subjects (0:36:00, 0:37:30 Pre interview).

After the interviews with the students the project leader seemed convinced that the chosen students had the required motivation to be accelerated towards the joint science exam (0:01:10 Post interview). The exam was a goal for the project, but it was still unclear whether or not it was actually possible. The motivation for having it earlier was to move the science foundation course (naturvidenskabeligt grundforløb) to the second half of the second year of the programme to make more time available in the remaining years, thus effectively having accelerated the students by half a year over two years (0:47:20 Post interview).

The students in the biotech class are going to be accelerated throughout the programme. How the acceleration is going to take place is not completely clear. At first it seemed as if it was a task primarily for the teachers, but at the information night it seemed to become at least as much a question of the dedication from the students. Due to the formal change from being a school programme to a gymnasium programme at some point during the process it seems that bureaucracy might end up playing a role in how the acceleration takes place.

It seems that the acceleration of the biotech class may take place in three forms. One is from simply speeding up the process of learning. That is what is meant by pushing the students and dedication. The second form of acceleration will take place by removing redundant teaching in the form of overlaps between the school and gymnasium. Examples of such redundancy are the organelles in the cell which are given simpler names in school biology or simply ignored and then reintroduced in gymnasium with the correct scientific names (0:07:00 Common meeting). The third form of acceleration lies in interdisciplinary collaborations. From experience the teachers know that it is common for students to have problems with connecting what they learn in one subject to what they learn in another particularly in mathematics. The implied student of the biotech class should be more able at doing this, but by having an increased focus on making collaborations between the subjects when these connections are needed the teachers hope to accelerate them even further.

The first two kinds of acceleration I am confident will be successful because it is what the students have been selected for and potential collaborations between the two institutions have already been identified and tested. The third kind of acceleration I am somewhat scepti-

cal of because of how they intend to implement the interdisciplinary collaborations. From what I gathered at the coordinating meeting and the common meeting they are going to focus on simply having the same topic in all subjects at the same time without actually mixing the classrooms. This leaves a lot of work for the students and the teachers should be aware of what each other are working on at the moment. Fortunately for this process the new reform of the school means that the teachers will be sharing workplace, thus easing the communication between them.

15.5 PHILOSOPHY AND INNOVATION

If the students are accelerated but they are still in school and gymnasium for the same number of years, what is the extra time then supposed to be spent on? That is what I will try to answer in this section.

When I was first introduced to the biotech class I was told that it would be a class with an extra emphasis on the philosophical aspects of biotechnology. This was also evident in both the coordinating meeting and the common meeting where the teachers were trying to come up with topics for interdisciplinary work between the subjects that included philosophy, such as ethics, cloning and gene manipulation (0:42:30, 0:48:00 Coordinating meeting and 0:36:40 Common meeting). They already had a teacher who was supposed to be teaching philosophy even though they hadn't decided on teachers for any of the other subjects.

At the information night you had to listen very carefully to find any mentioning of philosophy. The only time it was mentioned was as a side remark about what might be going to happen in the last part of the second year (1:43:20 Information night). Before that a new aspect of the biotech class had been introduced: innovation. Innovation was a central aspect of the two external talks during the information night by a representative from the Technical University of Denmark (DTU) and by two gymnasium students from the talent programme called Akademiet for Talentfulde Unge (The Academy for Talented Youngsters, ATU).

It would seem that innovation took over as the extra activity in the programme after the information night. At least I didn't hear philosophy mentioned any time after that, whereas innovation suddenly was the new buzzword (0:00:40, 0:42:10 Pre meeting and 0:35:00 Post meeting). The philosophy teacher was, however, still connected to the biotech class as he was one of the five people who conducted the interviews with the potential students.

Whether or not innovation ended up replacing philosophy or they both constitute a part of the teaching in the biotech class it is hard to see how either of them should make up for the extra time that

should be available. Both of them are supposed to complement other subjects and not actually take up time on their own. So what the extra time is going to be used for remains unknown. It would seem very plausible that the extra time is going to be spent on reaching a higher taxonomic level in the science subjects and possibly extending it beyond what is included in the official content of the subjects, but when that is going to happen remains unknown.

I don't think philosophy and innovation are as central to the biotech class as they try to make themselves and the future students believe. Philosophy only takes up a role as a topic for perspectives to the interdisciplinary work and may end up as an elective subject in the gymnasium part. Innovation is a buzzword for the talent activities the involvement of DTU and ATU may lead to, but those are extracurricular activities not directly connected to the biotech class in the case of ATU and will not include all the students and in the case of DTU will to the best of my knowledge mostly consist of lab exercises. Specific plans for innovation projects remain to be unveiled. Perhaps the science foundation course planned to be moved to the second half of the second year of the programme will contain innovation or philosophy projects.

The biotech class is not a fully developed talent activity, but they have never claimed to be so either. At the pre interview the project leader specifically says that it hasn't been planned further than the first two years in and that they will need to adapt the programme to what they experience along the way (0:22:00 Pre interview). This may hold part of the answer to why it isn't clear what the acceleration will be good for. They simply don't know yet.

15.6 ADAPTABILITY

Time is an essential resource. The biotech students will be at school for the same number of hours as the other students at Ordrup School and Ordrup Gymnasium. Their teachers are discussing how much they can push them, but they should still be social and take part in school activities alongside the other students. They will be offered the opportunity to take part in extracurricular activities after school where they are also supposed to do their homework, but they shouldn't become swots.

This section is about all the things the implied student of the biotech class should use his or her spare time for and how it changed while I followed the project.

At the coordinating meeting there is no specific mentioning of activities outside of school hours, but the teachers are discussing how much they can push the students when first they get used to it (0:16:20 Coordinating meeting). It is the same situation at the common meeting, but it is also pointed out that the new reform of the school sys-

tem might give them some extra time to spend on accelerating the students even further. Another thing the reform and the design of the biotech class might cause is a more changeable timetable that the students need to adapt to (1:22:10 Common meeting).

As earlier mentioned there is a change at the information night which makes it a question of the students' motivation and dedication for working harder rather than how much the teachers can push them to work (0:29:00 Information night). Some of them will be expected to take part in ATU activities during weeknights and activities at DTU both as part of their normal class hours but also as extracurricular activities (1:21:40 Information night).

At the pre interview the project leader made comments supporting the image of the implied students given at the information night and added that the students were expected to show up prepared for every subject (0:10:20 Pre interview). At the post interview the expectations for the students were much the same, but now they had learned from the interviews that most of the students had a busy spare time with many sports or similar activities (e.g. football, swimming, choir and violin).

It would seem that there are great expectations to the students' ability to adapt to a changing daily life and the amount of time they invest in the school. With the new reform of the school and the design of the biotech class this might mean that some of the students will feel pressured into dropping one of their activities, not signing up for extra activities or take part in fewer social activities.

"Finding out how far the students can be pushed" can be interpreted in at least two different ways. One way is to find out how far they can be pushed during class. Another way is to find out how far they can be pushed using homework and other activities. With the first interpretation the students' spare time activities won't necessarily be affected. With the other interpretation they will. My impression from the meetings and interviews is that the biotech class will use both interpretations. The students should work harder and be more dedicated in class and spend more time on homework after classes end.

The students in the biotech class are selected based on among other things their motivation for being in the class. This motivation along with other factors may cause them to eventually stop some of their spare time activities to make a sufficient amount of time available for the increased amount of work.

15.7 SUMMARY

This summary will give a description of the implied students which were selected this year. Perspectives on the implied students for future years are incorporated in the previous sections. In general the

implied students for the biotech class are described using only positive personal traits and a few negative characteristics of their current educational setting such as improperly challenged.

In this section I will first summarise what the changes in the implied students over the time I followed the project indicates about the implied students and then shortly describe and analyse some of the constant factors in the implied students.

The implied students for the biotech class are highly motivated for being in the class and want to build a talent for biotechnology. They are probably already quite good at the science subjects but don't have to be. Students who are gifted but struggling in their old class due to whatever reason, probably haven't been selected, especially not if they focused on that rather than their motivation for being in the class at the selection interview. The implied students are very mature for their age. They are willing to work hard and are dedicated learners. They know they are going to continue at university after the biotech class, probably in some kind of science most likely one with a connection to biology. Their dedication will be put to the test by the teaching at the school where they will be pushed to complete a large amount of work both in and outside of class. They may have to adapt their many spare time activities to the increased pressure from school work, but will be able to do so even with an ever changing timetable. During class they take an interest in the philosophical aspects of the science they are being taught and may come up with innovative new ideas about how to improve lab experiments or other things in their daily life. If the teaching in the biotech class doesn't live up to their expectations they might consider changing school again.

These were all descriptions of the implied students based on the categories that changed while I was following the project. There were, however, also aspects that remained constant throughout the period. Two of those were the expected geographical distribution of the students and interest level in the humanities.

15.7.1 *Geographical distribution*

Information about the biotech class was sent out by mail to the parents of all 7th graders in the Gentofte and Gladsaxe municipalities. They expected most of the students applying for the class to come from the area close to the school, some of them from a bit further away and only a few of them from the neighbouring municipality of Gladsaxe. The expectations ended up being correct and the students chosen for the class ended up fitting the expected distribution as well. When some of the rejected students were advised to apply for the similar class at Bagkost the parents usually replied that it was too far away (approximately 7 km). This shows that distance is an important factor for whether or not the students are going to apply.

15.7.2 *Interest in the humanities*

The teachers at Ordrup School did not expect the students to be interested in humanities. This was implied by the expectation that there would be no overlap between applicants for the biotech class and the HUMA class at Skovgårdsskolen (another school in the municipality). One of the applicants did in fact also apply for the HUMA class, but was rejected in Ordrup. The reason for the rejection is unknown but not based on the application for the HUMA class. What makes this lack of interest in humanities a relevant aspect is that the students are still expected to receive high grades in those subjects even though they are not interested in them. The same expectations were present at Bagkost when they initiated their biotech class, but this year or the next they are offering Latin as an elective subject specifically based on an interest among the students of their biotech class. Perhaps they will be surprised in Ordrup as well.

16 DISCUSSION

In this chapter I will discuss some of the limitations and implications of the previous chapter. I believe my observations and interviews gave a good idea of who the implied students were, but there were still some limitations as to what could be shown through this kind of analysis. What was shown, however, tells us quite a lot about how students are selected for talent activities and what determines this process.

16.1 POSSIBLE LIMITATIONS

In the previous chapter I focused on what changes occurred in the course of my observations and interviews. Some of the changes were identified based on the fact that some things weren't mentioned later e.g. philosophy. This lack of mentioning may simply be caused by a change of data collection method i.e. from meeting observation to information night observation or from observation to interview. Based on the way the changes emerge it would seem that only in the case of philosophy and innovation is there a potential for this being a factor. In all the other cases the change is introduced by either specific comments, such as when the principal of Ordrup School tells that the students should not be experts, but rather properly motivated, or by new insights into the number of interested students or their spare time activities.

In the case of philosophy and innovation I noticed a change at the information night, where philosophy was barely mentioned even though it had initially been at the heart of the biotech class, whereas innovation was suddenly introduced as a central aspect. The fact that philosophy wasn't mentioned during the interviews could be explained if it simply wasn't relevant to mention it at any point during the interviews. It does, however, seem odd that a central aspect of the biotech class wouldn't be mentioned at all in the course of more than 1 hour and 45 minutes of interview, especially seeing as innovation, which I propose took over its place and hadn't been mentioned before the information night is mentioned at least three times during the interviews.

Another critique that can be directed at the study is the use of statements from some of the teachers who only seem to take part in single meetings. If we look at the question of motivation or academic strength the main arguments for academic strength being more important than motivation up until the information night are statements

from teachers who only appear at one meeting each. Whether these are just the personal opinions of individual teachers who take part in the process of developing the biotech class at those meetings or an actual part of the implied students for the biotech class may be hard to tell. One could argue that since they express the same opinion independent of each other it is more likely to be part of the implied students, but it may just as well be a regular assumption about talents from the average school teacher. In more general terms it might be questioned whose opinion about the implied student at this point in the development process is the actual implied student. I would suggest that the implied student at any point in the developmental process is an image of the collective assumptions and expectations for the future students of all the people involved in the process, probably with an extra weight on the opinion of the project leader as he is the one responsible for the future direction of the project. This would imply that any teacher's idea of who the future students are is a valid part of the implied student. From a constructivist point of view the implied student at this early point in the development of the project can only be seen through what is said and done at a particular time e.g. at a meeting or at an interview.

16.2 IMPLICATIONS

In this section I will describe some of the implications of the way the implied students are formed in the talent activity in Ordrup and what may be said about the reasons for initiating the project in relation to the reasons for doing talent activities.

16.2.1 *Objectivity in the selection process*

The apparent need for more objective tools for selecting students for the biotech class is not based on what kind of students are intended for the class. It stems from a (reasonable) desire to avoid complaints from parents of potential students who were dismissed. A test such as the one proposed by the project leader does not necessarily tell anything about whether or not the student fits the programme it simply works as a tool for selecting students, which can be claimed to be objective. This means that it is not whether the students are the intended participants or not that becomes decisive for the selection process, but rather if it can be justified to the students' parents and the municipal administration. In other words some students who fit the profile for the programme may not be selected because there are other students who fit the selection profile better than them even though those students may not be as well a fit for the programme.

This principle can be expanded to all activities with a limited number of participants that have to justify who they choose as their par-

ticipants. This indicates that a lot of activities may not be choosing their participants based on who fits the program but rather who is most selectable based on whichever selection method they use and that there may be a quite significant difference between the two.

16.2.2 *Adaptive developments*

The implied students are adapted to the practical limitations and realities of the biotech class. As an example the implied students became willing to decrease their involvement in spare time activities to focus on homework and extracurricular activities when it became clear that a lot of the students selected for the class had time consuming spare time activities.

The applicability of this behaviour to other talent activities may mean that certain types of talent are not developed, because there are inherent practical limitations in the necessary formats of activities for a certain type of talent to be developed. An example could be the International Linguistics Olympiad. Denmark does not participate in this academic Olympiad possibly because there are no funds for it or because linguistics is not a gymnasium subject. This may mean that we are not going to develop any talents within the field of linguistics (at least until university level).

It may be somewhat interesting to relate this aspect of talent development to how talent can be considered situated in a certain culture as described in Section 4.4. If a certain talent is not valued by some culture there may very well be practical limitations as to the development of that talent and as such it will not be developed.

16.2.3 *Reasons for creating the biotech class*

If we look back at the three reasons for why we should do talent activities we may ask ourselves which of these the biotech class fulfils.

At the information night the speaker from DTU told about how we lived in an increasingly globalised world where the Chinese soon might outperform us if we don't care for our talents. This is an exact description of the first reason for doing talent activities. So even though it wasn't out of this need that the biotech class originated it is a reason for doing talent activities which it fulfils.

The second reason for doing talent activities is because it has a contagious effect on the other students in a class. If this was the reason for creating the biotech class it could be classified as an odd kind of disease control, since it is an attempt to move a number of talents away from the students they were supposed to inspire and instead put them together with students who are already "affected".

If the reason for making the biotech class was to increase the well-being of the talented students it would seem weird to choose such

well functioning students. Usually when this reason is applied it is because the activity is aimed at gifted students with social problems or who are struggling in other ways. The implied students for the biotech class are, however, not appropriately challenged in their old class, which actually justifies using this reason for creating the biotech class.

17

CONCLUSION

Who are we doing talent activities for? That was one of the questions I asked at the beginning of this thesis and at the beginning of this part (see Chapter 1 and Chapter 12). With the longitudinal study of the biotech class in Ordrup I have made a broad description of who the implied students for this class are and by looking at how this description evolved I have learned how the concept of talent might do so in other activities as well and what that means for the participants.

17.1 GENERAL CONCLUSIONS

The most important aspect of the implied students I have found is probably that there is a difference between the implied students whom the activity is made for and the implied students whom are selected for. To reach an indisputable selection process for the biotech class, they are now considering changing it so that the selection will be based on criteria which are considered more objective, but in fact are less connected to the intended students of the class.

From a research perspective it is interesting to see that the practical experience from teachers gives a cut off point for talent at the top 10 %, which is similar to what Gagné (2010) does in the DMGT; both that there is a cut off point and that it coincides with Gagné's. It is, however, also interesting to see how the group of gifted seems either absent or coinciding with the talented or motivated in the eyes of the teachers.

17.2 CONCLUSIONS SPECIFIC TO THE BIOTECH CLASS

For talent classes it may be relevant to see whether the organisers are able to look beyond their own teaching horizon in the prospects of the class. The teachers involved with the biotech class rarely looked beyond the scope of their own involvement and the implied student had in their view a tendency to be the ideal student at the end of the teachers' involvement which may not be the same as the ideal student at the end of the project.

Possibly due to the horizon of the organisers it seemed undefined what the extra time made available by the acceleration was supposed to be used for. It was, however, also made clear that the intention was to adapt the programme to the students' progress. In other words the organisers thought of it as being too early to actually decide more specifically what the acceleration should be used for. On top of that

my focus was on the involvement of Ordrup School and not so much on Ordrup Gymnasium, whereas what the extra time made available by the acceleration should be used for probably will be decided by Ordrup Gymnasium.

The implied students of the biotech class are highly motivated for being in the class and want to build a talent for biotechnology. They tend to be quite good in all subjects but especially the ones related to science, possibly so good that they find themselves improperly challenged in their old classes. They are very adaptable to new situations and open to changes in the structure of the teaching.

17.3 PERSPECTIVES

When choosing students for a talent activity one should consider what the purpose of the activity is and what type of students may gain the most from achieving that purpose.

In the case of the biotech class in Ordrup the implied student developed along with some of the aims of the programme. It was an adaptive process where talent and aims gradually became aligned. They are still not perfectly aligned, but as earlier mentioned the content of the class is still being developed. I think a lot of talent activities could gain from taking one step back and asking themselves what are the aims of this activity and who are the participants, and then look at how well they align.

18

COLLECTIVE CONCLUSION

In Chapter 1 I presented the three reasons for doing talent activities from Talentcamp05 (ScienceTalenter, n.d.). These were:

- Globalisation creates a demand for talents
- Talent is contagious and inspires the other students
- Talent development increases the wellbeing of the talented

These three arguments form the reasoning for why we should bother to do something for the talented.

To explore this topic at a deeper level I asked the follow up questions what should we do and who should we do it for. These questions were quickly followed by what are we doing and who are we doing it for. The motivation for asking these questions was to get a sense of how we can make the effort in the field of talent more effective so that we can increase the wellbeing of the talented, have the talents inspire the other students and meet the demand for talents in an increasingly globalised world.

In the following sections I will summarise the answers to these questions which I have found in the course of my work with this thesis.

18.1 WHAT SHOULD WE DO?

In Chapter 5 I reported on the seven types of gifted education provisions that Montgomery (2006) advocates for. These provisions were differentiated teaching, grouping of students, clubs and societies, mentoring, extension and enrichment, acceleration and distance learning. There is great support for differentiated teaching and grouping of students in the form of inclusive teaching (cf. Smith, 2006). Regarding acceleration the literature does not seem to agree. Freeman (2006) argued against it while Gross (2006a) and Lubinski et al. (2001) argue for it. Extracurricular activities for example in the form of academic Olympiads, science summer schools and science competitions have been looked at in many studies most of which tend to rate them positively (cf. Oliver and Venville, 2011; Wirt, 2011; Stake and Mares, 2005). Heller (2005) has argued that for the activities to have a lasting effect they must be long term oriented.

18.2 WHO SHOULD WE DO IT FOR?

There are more than 200 definitions of giftedness and talent (George, 1997) and they change over time and depend on the culture in which they are made (Moltzen, 2009). IQ has so far been the best-documented predictor of achievement (Duckworth et al., 2007) but many other models are trying to explain high achievement (cf. Sternberg, 1985; Gardner and Hatch, 1989; Gagné, 1985). Ericsson et al. (1993) has been promoting the idea that high achievement, or expertise as he calls it, primarily originate in laborious work, also known as deliberate practice. Duckworth et al. (2007) in support of this view describes the potential high achievers based on a concept called grit.

With the Differentiated Model of Giftedness and Talent (DMGT) created by Gagné (1985) we are presented with the view that who we should do talent activities for depends on what they should end up being good at and that the success of it among other things depends on their motivation and what Duckworth et al. (2007) would call grit.

Based on the different views of giftedness, talent and expertise I would argue that who we should do talent activities for depend on what we are doing for them. Giftedness of whatever type it may be according to the DMGT is definitely able to accelerate the rate at which a person is improving their competence in a field, but it still takes time to become competent in a field. Ericsson et al. (1993) showed that on average it takes about 10,000 hours of deliberate practice to become an expert in a field, but with a very large variance. My guess is that giftedness is the primary source along with environmental factors for this variance.

18.3 WHAT ARE WE DOING?

In my study of the talent activities in Denmark I found 37 different activities spread over six formats. I was able to sort them into three types of activities: talent nurture, interest activities and talent development. Most of the activities had a competitive format and were directed at a specific field.

Of the provisions suggested by Montgomery (2006) they mainly covered clubs and societies, extension and enrichment and distance learning. Differentiated teaching and grouping of students should, two of the other provisions, should be covered by the schools while acceleration doesn't seem to be used except for in extremely rare cases.

If we look towards the reasons for doing talent activities we see that a lot of the activities are directed towards the first reason, possibly because a lot of the funding comes from companies that wish to gain from the future talents. The second reason for doing talent activities is rarely the aim, in fact I can think of only one activity with that aim. The third reason is present in the aims of some activities though most

of them still focus on those who are talented rather than those who are gifted.

18.4 WHO ARE WE DOING IT FOR?

To get a sense of whom we are doing the talent activities for and why we have chosen them I did a longitudinal study of the biotech class in Ordrup in its initial phases. I found that even though the organisers had a pretty good idea about who they wanted for the biotech class they ended up thinking they should use a selection strategy which did not select for those criteria they wanted the students to fulfil. In this year's selection they did, however, select according to the criteria, but ended up getting complaints from parents of rejected students which focused on the lack of objectivity in the selection process.

Motivation was the primary criterion for selection for the biotech class. A high level of maturity and independence also weighed heavily in the selection process. The organisers did not seem to make much of a distinction between giftedness and talent as they equated logical intelligence with great mathematical performance. It seemed that the format of the biotech class and its implied students were in a constant alignment process going both ways where one would adapt to changes in the other.

The selection process in Ordrup shows that sometimes we do not choose the students who fit the programme the most, but rather the students we can justify having chosen. This is not to say that the students chosen for the activities do not fit them but rather that there may be other students with a better fit.

Part IV

APPENDIX

A

CATEGORISATION OF TALENT ACTIVITIES

A table is shown on the following pages containing the categorisation of all talent activities. In the third column Interest corresponds to interest activities, Nurture to talent nurture and development to talent development.

Activity name	Activity format	Activity type
Experimentarium Science Klub	Leisure activity	Interest+Nurture
Ungdommens Naturvidenskabelige Forening	Leisure activity	Interest
Biotech Academy Camp	Leisure activity	Nurture
Gifted Children	Leisure activity	Nurture
Nø(r)dskole	Leisure activity	Nurture
Historiekonkurrencen	Competition	Interest+Nurture
Venture Cup	Competition	Interest+Nurture
Unge Forskere	Competition	Nurture+Development
DTU Robocup	Competition	Interest
FIRST LEGO League	Competition	Interest
European Business Game	Competition	Nurture
Forskerspirer	Competition	Development
Science Cup	Competition	Development
Skills Denmark	Competition	Development
Filosofi Olympiaden	Academic Olympiad	Interest+Nurture
Dansk Datalogi Dyst/IOI	Academic Olympiad	Interest+Nurture

Table 3: Categorisation of talent activities (continues)

Activity name	Activity format	Activity type (continued)
Geografi Olympiaden	Academic Olympiad	Interest+Nurture
International Linguistics Olympiad	Academic Olympiad	Interest+Nurture
Biologi Olympiaden	Academic Olympiad	Nurture+Development
Science Olympiaden	Academic Olympiad	Nurture+Development
Georg Mohr	Academic Olympiad	Interest
Fysik Olympiaden	Academic Olympiad	Nurture
Internationale Astronomi Olympiade	Academic Olympiad	Nurture
Kemi Olympiaden	Academic Olympiad	Nurture
Matematik A-lympiaden	Academic Olympiad	Development
Coursera	Online activity	Nurture+Development
Khan Academy	Online activity	Nurture+Development
Project Euler	Online activity	Interest+Development
Akademiet for Talentfulde Unge Øst	Pull-out activity	Nurture+Development
ScienceTalenter	Pull-out activity	Nurture+Development
Talent med Bredde	Pull-out activity	Interest
Akademiet for Talentfulde Unge Region Midt	Pull-out activity	Development
Akademiet for Talentfulde Unge Region Syd	Pull-out activity	Development

Table 3: Categorisation of talent activities (continues)

Activity name	Activity format	Activity type (continued)
EduForce (junior)	Pull-out activity	Development
BIOTEK Bagsværd Kostskole og Gymnasium	Talent Class	Development
EduTechLab	Talent Class	Development
BIOTEK Ordrup Skole og Gymnasium	Talent Class	Development

Table 3: Categorisation of talent activities

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