

Characteristics of a Challenging Learning Environment Affecting Students' Learning Processes and Achievements

Suzanne Vrancken and Sanne Tromp

Introduction

Talented students can do more than is offered to them in the regular curriculum. These students need more challenging education to fully use their capabilities and achieve optimal talent development. Education for talented students should be adapted to their needs and capacities (Heller, 1999; Tomlinson, 2005; VanTassel-Baska, 2003). The national Inspection of Education concluded that Dutch secondary education is insufficiently adapted to talented students' needs and that teachers do not challenge their most talented students appropriately (Inspectie van het Onderwijs, 2012).

In 2011, the Dutch government issued a policy aiming, amongst other things, at schools offering a motivating and challenging learning environment appropriate for talented students (OCW, 2011). Schools are encouraged to develop 'excellence programmes'. Schools that already offer excellence programmes can serve as sources of knowledge and inspiration for schools that want to develop such a programme.

Junior College Utrecht (JCU) is an example of such an excellence programme, focused on science and mathematics. Since 2004, JCU offers a challenging learning environment to a selected group of 100 talented students who are in grade 11 and 12 of their pre-university education. Participating students are selected based on previous achievements and motivation. Over two years, the students attend their biology, chemistry, physics and mathematics courses at JCU based at Utrecht University. The lessons in non-science subjects are attended at students' home schools during the remaining three days.

JCU offers an accelerated and enriched science curriculum to students. The regular curriculum is addressed in 60% of the teaching time; the remaining time is spent on enrichment activities, like interdisciplinary modules and research activities (Van der Valk, Van den Berg & Eijkelhof, 2007). Despite this challenging curriculum, JCU students score well above average in the national exams, research by Van der Valk, Grunefeld and Pilot (2010) showing that the adapted learning environment has a positive influence on student

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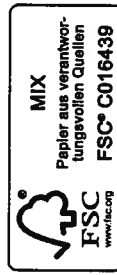
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empowerment. Therefore, JCU is considered an example of a challenging learning environment for talented students.

Research Aim and Questions

The aim of the research outlined in this study is to identify characteristics of a challenging learning environment that affect the learning processes and achievements of 11th and 12th grade pre-university students. Three research questions are addressed:

- 1) What, according to students, are the characteristics of the JCU learning environment?
- 2) What do students perceive to be the effects of the JCU learning environment on their learning processes and achievements?
- 3) How do students relate perceived effects to the characteristics of the JCU learning environment?

Theoretical Framework

To empirically identify the characteristics of a learning environment that influence students' learning processes and achievements, the concepts 'learning process' and 'learning achievement' are defined. A learning process refers to students' growth and development concerning knowledge, skills, perseverance and self-regulation (Dembo & Eaton, 1997). Learning achievements indicate students' results and accomplishments (Solaiman Ali, 2007). Students' learning processes and achievements are interrelated: changes in a student's learning process will affect achievements, and vice versa.

Literature describes a wide variety of factors that influence the learning processes and achievements of talented students. Theoretical models, like the Differentiated Model of Giftedness and Talent (Gagné, 2002) or Pudeu Pyramid Model of Talent Development (Feldhusen, 2003), describe coherency between influential factors and development of talented students. However, given the nature of the research questions and the selected research approach, these comprehensive models will not be utilized in this study. An open model is developed which allows for inductive data collection and analysis (figure 1). This study focuses on the learning environment within a school, individual capacities and previous experiences, and the learning environment outside

the school are disregarded in this study even though it is known that these factors influence students' learning processes and achievements.

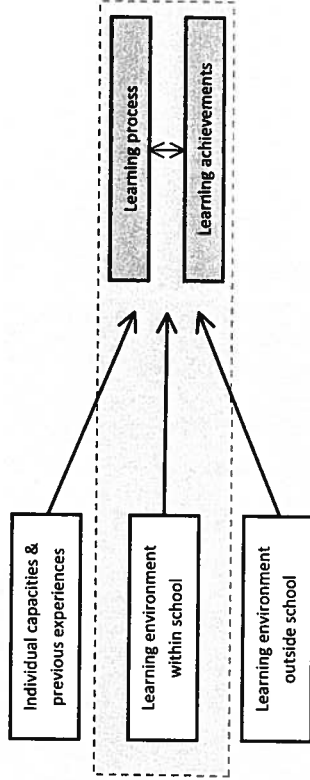


Figure 1: Applied model of factors influencing students' learning processes and achievements

Method

The study is based on a grounded theory approach (Creswell, 2009) where students' experiences with the JCU learning environment serve as the starting point. This inductive research method ensures that results are directly derived from students' experiences without intermediate theoretical interpretations. JCU is selected as the site for data collection based on critical case sampling (Patton, 2001).

Data Collection

Data on characteristics of the JCU learning environment are collected from graduation speeches of 240 JCU students from 2006 to 2012 (except 2010) and four open group interviews with three students in 2012. Semi-structured interviews with nine students are used to discuss the identified characteristics and to gain insight into effects students relate to specific characteristics of the JCU learning environment. All data are transcribed verbatim. Summaries of the most important interview outcomes were sent to the respondents for member checks.

Data Analysis

Qualitative data analysis was performed in five steps. First, all speeches and one open group interview transcript were coded "in vivo" i.e. students' original words were used as codes, to identify characteristics of the JCU learning environment and students' perceived effects. The second step was grouping and categorizing all codes to get two comprehensive coding schemes: one scheme to code characteristics and the other to code perceived effects of the JCU learning environment. Both schemes were discussed with the second researcher until consensus was achieved. Third, all speeches and open group interview transcripts were analyzed using the coding scheme to identify characteristics of the JCU learning environment. The coding scheme was adjusted intermediately to maintain alignment with the original data. The final coding scheme presented an overview of the characteristics of the JCU learning environment according to students (research question 1). This overview was presented to nine students in semi-structured interviews where they were asked about perceived effects of the identified characteristics.

Fourth, all semi-structured interview transcripts were coded using the coding scheme of perceived effects generated in the second data analysis step. Since the speeches and open group interviews also contained valuable information on students' perceived effects of the JCU learning environment, 50% of the speeches and all open interview transcripts were coded using the coding scheme of perceived effects. The coding scheme was adjusted during data analysis to ensure alignment with the original data. The final coding scheme presented an overview of students' perceived effects of the JCU learning environment (research question 2).

Fifth, an overview of quotations encoded with at least one characteristic and one effect was produced to gain insight into what effects students relate to specific characteristics of the JCU learning environment (research question 3). The second researcher validated 40% of all encodings which resulted in an intercoder agreement of 95%.

Results

(1) What, according to students, are the characteristics of the JCU learning environment?

Data analysis resulted in eleven characteristics of the JCU learning environment (figure 2). Students describe science education at JCU as challenging

due to the accelerated curriculum and enrichment activities. The shared culture of excellence among participants in the JCU learning community is also put forward by students as an important characteristic. Students appreciate being grouped with other motivated students who are willing to work hard in order to get good results. Teachers' teaching skills are also mentioned. Students value their teachers' content knowledge and the way they enthuse them in their subjects.

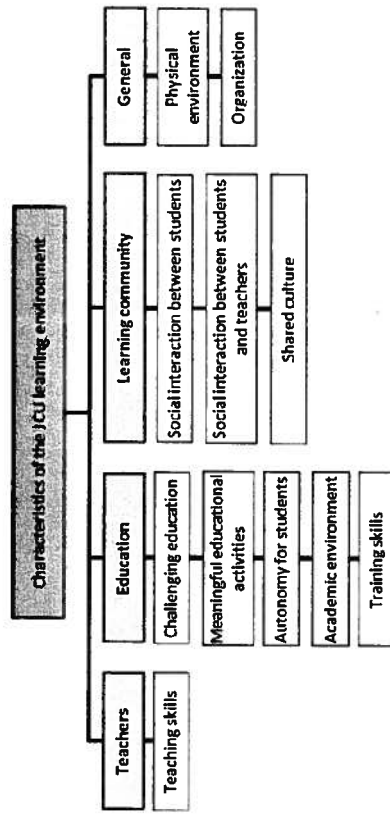


Figure 2: Overview of characteristics of the JCU learning environment

(2) What do students perceive to be the effects of the JCU learning environment on their learning processes and achievements?

Students perceive twelve kinds of effects of the characteristics of the JCU learning environment (figure 3). An effect students frequently refer to is acquisition of knowledge. Students also become more enthusiastic about science courses which lead to an increasing urge to learn and work attitude. Students indicate that their active participation in the classroom increases and they feel more responsible for their own learning process. Changing results are also attributed to characteristics of the JCU learning environment, whether these changes are positive or negative.

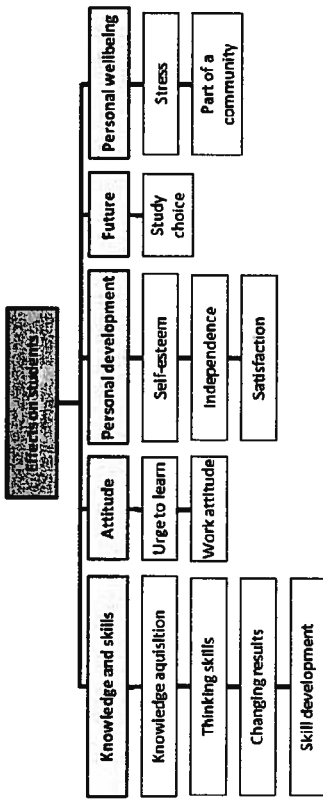


Figure 3: Effects students attribute to the characteristics of the JCU learning environment

(3) How do students relate perceived effects to the characteristics of the JCU learning environment?

Students draw various relationships between perceived effects and the characteristics of the JCU learning environment. Table 1 provides an overview of what characteristic of the JCU learning environment students relate to a perceived effect. The numbers in the table indicate how often a characteristic and an effect are attached to the same quotations during data analysis. How students relate characteristics of the JCU learning environment to perceived effects will be described on the bases of students' reported experiences.

Students perceive that they gain much new knowledge at JCU. This effect is most often related to meaningful educational activities, like doing independent research or working on interdisciplinary modules.

"I really learned a lot from my thesis research at the university research group. You work together with scientists and share your knowledge with each other. That was a very valuable experience."

Some students perceive negative effects on their knowledge acquisition due to the challenging education at JCU. These students feel that, due to the accelerated curriculum, there is not enough time to learn all the content knowledge thoroughly.

"Because of the high pace you don't always have time to practise everything and take time to learn. I feel that I know the things I learn less thoroughly."

Engagement in enrichment and research activities is known to have a positive effect on students' knowledge acquisition and talent development in science subjects (Pryyt, 2002; Rogers, 2007; Reis, & Renzulli, 2010). However, it is important to consider differences between talented students; all students learn at their own pace (Tomlinson, 2005; Subban, 2006; Rogers, 2007). An accelerated curriculum can lead to negative effects on students' learning processes and achievements and result in stress among students.

It is noteworthy that only a few students relate their knowledge gains to teachers' teaching skills, because in literature teachers are considered the most important factor in students' education (Hattie, 2009). However, students do relate growth in their urge to learn to teachers' teaching skills. Teachers are enthusiastic about their subject and ask students challenging questions and this stimulates students' curiosity and enthusiasm for science. These findings are consistent with literature (Pryyt, 2002; Croft, 2003; Hattie, 2009).

"The teachers at JCU ask more challenging questions. I like that and it stimulates me to ask more challenging questions too."

The shared culture of excellence among participants of the JCU learning community is also related to students' urge to learn and their work attitude. Students appreciate being grouped with other talented students who are interested in science. Most JCU students have a competitive spirit and like being challenged by other students. However, some students experience negative effects of being grouped with high-ability peers.

"I never want to be the worst at anything. I always want to be the best, but the bar is set much higher at JCU than at my own school."

"I'm used to always being the best of my class, but at JCU I'm not. I feel really stupid sometimes."

Literature shows that peers can stimulate and challenge each other (Gallagher, 2003; OECD, 2010), especially in homogeneous classrooms (Lens, & Rand, 2002). Kulik (2003) and Subotnik, Olszewski-Kubilius and Worrel (2011) found that talented students may experience a slight drop in self-esteem when grouped with other high achievers.

Table 1: Overview of how often students relate a characteristic of the learning environment to a perceived effect

	Teachers	Education				Learning community		General			
		Challenging education	Academic environment	Autonomy for students	Meaningful educational activities	Training skills	Social interactions and teachers		Social interaction between students	Share culture	Physical environment
Knowledge and skills											
Thinking skills	2	5	3	8					4		
Knowledge acquisition	2	16	6	5	29	2	1	3	2		
Skill development	1	2	1	1	5	10		3			
Changing results	4	8	7	2	1	1	1	3			1
Attitude											
Urge to learn	16	11	3	8	11	2	2	6	16		
Work attitude	5	9	1	7	4	5	5	5	17	2	
Personal development											
Satisfaction		10		1					1		
Independence		4	1	11	1	1	1	1		3	1
Self-esteem		5	2	2	2	3	5	7	2	1	
Future											
Study choice	1	12	11	4	41	1					
Personal well-being											
Stress		9		2	2					5	2
Part of a community		1	1	1	4	1	3	30	10	1	

Students also experience increasing self-esteem and satisfaction with their achievements. In the regular curriculum, they never had to work hard to get good grades, but at JCU they do.

"I rather work hard and get a 6 (B-), than do nothing and get an 8 (A). The results I get at JCU are much more satisfying and I can really be proud of my grades."

Lens and Rand (2002) found that talented students often attribute good grades to the low level of a test instead of to their own competence. Students feel more competent when they are challenged.

Conclusion

The aim of this study was to identify characteristics of a learning environment that affect the learning processes and achievements of 11th and 12th grade pre-university students. This study identified eleven characteristics that contribute to creating a motivating and challenging learning environment for talented students. Analysis of the effects perceived by students shows that changing results are only a small part of the effects; changes in students' learning process are more common.

The results also show that, for students, effects of the learning environment can be positive or negative. When designing a learning environment for motivated and talented students, it is important to consider differences between the members of a group. The results of this qualitative research project could be used as a basis for the development of a quantitative instrument that aims to measure the characteristics of a challenging learning environment and their effects on students' learning.

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