The influence of subject disciplinary studies on students’ implicit theories of intelligence and achievement goals in one Swedish upper-secondary school

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Abstract
Upper-secondary schooling in Sweden is organised for pupils aged 16–19 in 17 different national study programs. Of these 3 are theoretical programs with mainly academic content. They prepare for further (higher education) studies. The present investigation looks at the influence from these programs on 845 upper-secondary students’ implicit theories of intelligence and achievement goals. These theories have been shown by international research to have significant influence on pupils learning and achievement which is important knowledge for teachers and teacher students. The hypothesis is that exposure to one of the programs, the Natural Science Program, a) increases individual’s beliefs about intelligence as fixed and inherited b) weakens the pupils tendency to choose mastery goals, and c) increase performance approach and the adoption of avoidance goals. This can have negative effects on pupils’ achievement. We have investigated this using 3 × 3 between-subject ANOVA. The investigation showed that beliefs in intelligence as fixed and inherited increased among pupils who spent two or three years at the Natural Science Program and that they also showed a stronger focus on both performance avoidance and performance approach goal orientations compared with other academic program pupils.

Keywords
implicit theories of intelligence; achievement goals; upper-secondary school

Introduction
Beliefs about the nature of intelligence have played an important role for the development of educational systems (Sternberg & Kaufman, 2011). They also seem to affect individuals’ learning strategies (Dweck, 1999; Carr & Dweck, 2011), cognitive performance (Cury, Elliot, Da Fonséca & Moller, 2006), educational achievement (Blackwell, Rodriguez & Guerra-Carrillo, 2015) and the achievement goals the student, the teacher and the classroom as a collective adopts (Middleton & Midgley, 1997; Patrick, Kaplan & Ryan, 2011). It is also known that implicit naïve beliefs of intelligence may develop differently in relation to different school subjects with possibly key implications for the core of a teacher’s work in relation to student learning and development (Jonsson, Beach, Korp & Erlandson, 2012; Mascret, Roussel & Cury, 2015; Myers, Nichols &
White, 2003). This article aims to investigate the influence from different academic disciplines on Swedish upper-secondary students implicit theories of intelligence and achievement goals. Dweck (1986) and Dweck and Legget (1988) point out that implicit theories of intelligence could influence the adoption of different achievement goal orientations. Tuominen-Soini, Salmela-Aro and Niemivirta (2011; 2012) showed that achievement-goal profiles among upper-secondary school students are fairly stable (50-60% did not change profile) but suggest that academic choices could play an important role in the individual development of achievement goals. These issues are given attention in the article.

Implicit theories of intelligence

A key point of departure for this study is the theoretical framework of Implicit Theories of Intelligence by Carol Dweck. This theory asserts that when a learner believes that intelligence is dynamic and possible to improve they will achieve better learning results compared to if they believe it to be fixed and unchangeable (Blackwell et al. 2015; Rattan, Good & Dweck, 2012). The dynamic view has been shown to be particularly successful in combination with the incorporation of mastery goals (Urdan & Mestas, 2006) whilst the beliefs that ability is fixed seems to lead to the adoption of performance goals that are less beneficial for learning and achievement. It is therefore important to further investigate how to stimulate the adoption of mastery goals among students along with their beliefs that any ability can improve through effort and application. Implicit theories of intelligence are the naïve beliefs people hold about their own and other people’s abilities to learn. They are developed within a sociocultural context and play an important part in learning and achievement (Carr & Dweck, 2011; Dweck & Legget, 1988). There are essentially two forms of implicit theories of intelligence. One of them positions intelligence as fixed. This is called an entity theory. The other sees intelligence as changeable and dependent on effort and practice, which is defined as an incremental theory.

Entity theories of intelligence can make performance better and easier when people believe that they have a high, fixed ability, but having this implicit theory does not help in the face of setbacks or as a means to stimulate intellectual growth (Dweck, 1999). For example, according to Carr and Dweck (2011) the majority of students with an entity theory of intelligence did not take the chance to increase their knowledge and capacity by taking on novel tasks that forced them out of their comfort zones. Moreover, when facing difficult obstacles they also gave up their challenges more easily compared with students who believed that practice and effort could increase intelligence.

Another problem with entity theories is that if the student believes that performance is due to a fixed ability, it is this inherent capacity that is being questioned when taking a test. This shifts the focus of the task to the person and steals energy that could be used for solving it. In general previous research has found that beliefs about intelligence as genetically inborn and fixed decrease motivation, performance, and grades, whilst beliefs that intelligence is dynamic and dependent on effort increase these concepts (Blackwell, Trzesniewski & Dweck, 2007; Blackwell et al., 2015; Carr & Dweck, 2011; Dweck, 1999).
When Jonsson et al. (2012) investigated implicit theories of intelligence the results showed significant differences between upper-secondary schoolteachers dependent on academic discipline. Upper-secondary teachers in mathematics had lower beliefs in intelligence as changeable and stronger beliefs in intelligence as fixed compared to teachers in social science and practical disciplines. Further research shows that teachers with a preference for entity theories of intelligence do not promote the students inner motivational resources (Leroy, Bressoux, Sarrazin, & Trouilloud, 2007), have stronger tendencies of creating a competitive climate in class (Trouilloud, Sarrazin, Bressoux & Bois, 2006) and prefer to diagnose a student’s ability from their initial achievement (Butler, 2000).

Recently Mascret et al. (2015) confirmed these patterns. They found that science teachers, particularly males, did not favour beliefs about intelligence as dynamic and changeable compared to liberal arts teachers. This raised the question as to whether they taught students differently because of their discipline and what effects this might have. Rattan et al. (2012) showed that instructors holding entity theories of intelligence in math based their judgments of students on their initial performance and kept to this judgment of their ability to learn mathematics to a higher degree than those high in incremental theories. This affected their view of the role of feedback and was important to student learning outcomes. It is thus highly important to investigate what effect an exposure to mathematics/science can have. If different discipline environments (such as mathematics, social science and art) encourage different beliefs about the nature of ability and motivation then it may also matter how long time a pupil has spent within them.

Incremental theories of intelligence and mastery goals may be more seldom present in classrooms where math and science is taught compared to social science (Mascret et al., 2015; Rattan et al., 2012). In this study, the academic discipline environments are represented by three programs (Natural Science, Social Science and Aesthetic Subject Program) at an upper-secondary school in a middle class area in Sweden. This is not a longitudinal design; instead we treat the program itself and time at this program as the independent variables.

The Achievement goal construct

The achievement goal construct was developed in the 1970s and grounded in a distinction between mastery and performance goals. It focuses on the goals a person has for engaging in a learning process (Elliot, 2005; Midgley et al., 1998, 2000). Achievement goals were initially introduced with two different dimensions. One concerned competence development, the mastery goals, and the other the purpose for demonstrating competence, the performance goals. The distinction ‘avoidance goals’ were added later (Middleton & Midgley, 1997; Patrick et al., 2011).

Today the theory of achievement goal constructs distinguishes between three types of goal orientation. Firstly there are mastery goals that correspond to the will to improve ability, learn new things, or master subjects. Secondly there are performance-approach goals, which correspond to the desire to demonstrate ability and outperform others as a proof of one’s own ability. Thirdly there are performance-avoidance goals that correspond to the will to not be seen as a looser that is outperformed by others (Darnon,
Dompnier, Gilliéron & Butera, 2010; Pintrich, 2000). Previous research has shown that mastery goals correlate positively with persistence, effort and positive attitude toward school but that performance goals, also called ego goals, have a focus on competition and can decrease achievement if it generates high levels of anxiety (Urdan & Mestas, 2006).

Recently Tuominen-Soini et al. (2011; 2012) investigated stability and variability in the development of achievement goals among students in Finland in their transition to upper-secondary school and between 11th and 12th grade. They approached achievement goal theory with a multiple goal perspective (Niemivirta, 2002), where several goals exist within us all, but where specific goals are more or less present dependent on the importance the individual attach to them in school settings. The research team found four profiles, indifferent (the students did not favour any achievement goal orientation), success-oriented (high in mastery and performance-related orientation), mastery-oriented (favoring mastery goals but scored low on performance approach/avoidance) and avoidance-oriented (favoured avoidance goals and scored low in mastery orientation).

These profiles were relatively stable and 50-60% of the students kept to their initial profile. Moreover, many of those that changed did so to a similar group profile. Tuominen-Soini et al. (2011) suggested therefore that contextual change and academic choices can be of importance in the development of achievement goal orientation among students. Achievement goal theory considers thus not only individual variables but also the context, such as the goal structure of the classroom. This involves the students’ perceptions of the purpose for approaching academic tasks and successful achievement at the classroom level (Patrick et al., 2011).

Teachers’ practices are also important for achievement goal theory as the rules, norms and routines implemented by the teacher influence the students’ perception of goal structure (Wolters, 2004). Researchers have found that reduced motivation and achievement can be explained by the change in the achievement goals students perceive teachers to emphasize in different grades and changing classroom contexts (Anderman & Midgley, 1997; Pintrich, 2000). Specifically this decline has been associated to differences between classrooms with high or low mastery goal structures in the upper-grades of the elementary school and upper-secondary school levels (Patrick et al., 2011). Changes in motivation came from the increased focus on relative ability and the social comparison between students and groups of students (Friedel, Cortina, Turner & Midgley, 2010).

**Upper-secondary school in Sweden**

Upper secondary education in Sweden is by far the most common of the post-compulsory forms of education. It is provided nationally in most local education authorities in the country and is organized in the form of 18 national study programs that normally run for three years each. Each national program comprises a singular nationally approved content structure and set of nationally stipulated objectives comprising both academic options, such as the natural sciences or the social sciences program, and vocational options, such as the hotel and catering program or the vehicle maintenance program. Our investigation involves three of the academic programs offered within upper-secondary (10th – 12th grade) schools that prepare students for future higher education: specifically the Natural Science, Social Science and Aesthetic Subjects
Programs. Admission to the programs is governed by performances and grades at the compulsory school level and is also described in terms of interests and commitments toward the particular field on the part of the pupil. The Natural Science Program in the Swedish upper-secondary school contains significantly more of the discipline of mathematics and the natural sciences than the other programs do.

Research questions

In this study we investigate the influence of a specific program, with focus on the different year groups (10th, 11th and 12th grade) on students’ implicit theories of intelligence and achievement goal orientation (personal and perception of teacher and classroom). We do not investigate implicit theories of intelligence toward a specific discipline and we do not follow the same individual as in a longitudinal design; it is the effect of degree of exposure on implicit theories of intelligence and achievement goals that are being investigated across three different year groups at three different programs. This represents a quasi-experimental design where the program and time spent on it are seen as a variation of treatment. Research by for example Beach (2003), Blackwell et al (2015), Dweck (1999), Jonsson et al. (2012), Jonsson and Beach (2012), Mascret et al. (2015), Myers et al. (2003) Niemivirta (2002), Tuominen-Soini et al. (2011; 2012) and Rattan et al. (2012) have informed the research. The hypotheses are:

(1) The students at the Natural Science Program will show increased beliefs in entity theories and weaker beliefs in incremental theories of intelligence their last year at the program compared to Social Science and Aesthetical Subjects Program students their last year.

(2) The students at the Natural Science Program will show increased performance approach and avoidance goal orientation and decreased mastery goal orientation their last year at the program compared to Social Science or Aesthetical Subjects Program students their last year.

Method

Participants

We measured all students (N = 845) at three programs (Natural science, Social science and Aesthetic Subject Program) at one middle-class, upper-secondary school in a small town (100 000 habitants) in Sweden. The participants in this investigation were all between 16 and 19 years old. They were spread over 40 classes (the total school). (See Table 1 below). The school was centrally located in a small Swedish city in a middle class area.

Measures

The Implicit theories of intelligence scale. A Swedish translation of Dweck’s (1999) Theories of Intelligence Scale (TIS) was used to assess the students’ entity and
incremental theories of intelligence (see Appendix 1). This translated version has been used in previous studies by the research team (Jonsson & Beach, 2010; 2012; Jonsson et al., 2012). The participant received 8 items (4 entity and 4 incremental) with a brief contextualization, before the items where they were suggested to think about social science (N = 300) or math (N = 538). The questionnaires were randomised between individuals within the same classroom and over programs/grades. The social science/math questionnaires were collapsed into general scores of entity and incremental for each program/grade. A ten point scale was used for ratings. The Cronbach alpha for entity items were .699 and for incremental items .832.

The Patterns of Adaptive Learning Scale (PALS). The Pattern of Adaptive Learning Scale (PALS; Midgley et al., 1998, 2000) has been developed and refined in the investigation from the perspective of goals orientation theory in order to examine how learning environments may influence student motivation and behaviour. We have used a Swedish translation (see Appendix 2) of three of the five scales: the student assessment scale of a) personal achievement goal orientation; b) perception of teacher’s goals and c) perception of the goal structure in the classroom. All three scales were specialized in items related to mastery goals, performance approach goals, and performance avoidance goals, with nine different combinations of goal orientations. Cronbach alpha for Personal was: performance avoidance goals .798, performance approach goals .698 and mastery goals .813. Cronbach alpha for Teacher was: performance avoidance goals .491, performance approach goals .456 and mastery goals .626. Cronbach alpha for Classroom was: performance avoidance goals .612, performance approach goals .614 and mastery goals .421. We used a 10 point scale where 1 = Strongly disagree and 10 = Strongly agree.

Procedure

Data was collected during one week in the middle of the autumn term. Firstly we informed the students about their right not to participate. After this they received the instrument and responded to the items. They were asked not to talk to each other and were told that they could raise their hand and ask the researcher (who stayed in the classroom) if they had any problems or questions about the procedure. This was repeated with every class.

Data analyses

ANOVA was used in order to investigate if and how implicit theories of intelligence and achievement goals differ between programs and the time spent at the program at
the Swedish upper-secondary school. Levene’s test was not significant (the variance was homogeneous) which allowed us to continue with the ANOVA-analyses. Firstly the entity and incremental theories of intelligence were analysed with the between-subject factors Program (Natural Science Program, Social Science Program and Aesthetical Subjects Program) and Time (10th grade, 11th grade or 12th grade). This was done in order to solve the question of influence of different disciplinary programs and time exposed to these programs on students’ implicit theories of intelligence. We also performed a within-subject analysis using repeated measure investigating which theory, entity or incremental, that dominated the students’ mind-sets.

Secondly the students’ achievement goal orientation was analysed. Again we applied ANOVA but this time on the dependent variables Performance Avoidance Goals, Performance Approach Goals and Mastery goals with the between-subject factors Program (Natural Science Program, Social Science Program and Aesthetical Subjects Program) and Time (10th grade, 11th grade or 12th grade). This analysed the effect of different disciplinary programs and time exposed to these programs on students’ achievement goals.

Results

Implicit theories of intelligence

The two 3 x 3 between-subject ANOVAs in Table 2 represent the effect of what kind of program the student attended and time spent at the specific program on the students’ entity and incremental theories of intelligence.

One main effect of Time spent at the programs was found for the dependent variable Entity theories, \( F(2, 824) = 6.02, p < 0.01, \eta = 0.014 \). Students attending 12th grade

| Program   | Grade | Entity theories | Incremental theories |
|-----------|-------|-----------------|----------------------|
| SSP       | 10th  | 4.26 (2.37)     | 6.67 (2.19)          |
| SSP       | 11th  | 4.34 (2.18)     | 6.08 (2.28)          |
| SSP       | 12th  | 4.18 (1.86)     | 5.45 (1.68)          |
| Total (N = 399) |       | 4.26 (2.19)     | 6.19 (2.15)          |
| NSP       | 10th  | 3.84 (2.12)     | 6.55 (2.17)          |
| NSP       | 11th  | 4.67 (2.44)     | 5.77 (2.36)          |
| NSP       | 12th  | 5.20 (1.60)*    | 5.10 (1.65)          |
| Total (N = 230) |       | 4.48 (2.16)     | 5.89 (2.17)          |
| ASP       | 10th  | 3.78 (1.76)     | 6.58 (1.82)          |
| ASP       | 11th  | 4.24 (2.31)     | 6.21 (2.10)          |
| ASP       | 12th  | 4.36 (1.72)     | 5.23 (1.66)          |
| Total (N = 198) |       | 4.05 (1.94)     | 6.16 (1.94)          |
| TOTAL (N = 373) |       | 4.04 (2.18)     | 6.62 (2.09)          |
| TOTAL (N = 236) |       | 4.41 (2.29)     | 6.02 (2.26)          |
| TOTAL (N = 218) |       | 4.53 (1.81)**   | 5.30 (1.66)***      |
| Total     |       | 4.28 (2.13)     | 6.10 (2.12)          |

Note: SSP: Social Science Program, NSP: Natural Science Program, ASP: Aesthetic Subject Program, *p < 0.05, **p < 0.01 and ***p < 0.001.
showed the highest ratings of entity theories compared to students in 11th grade and the lowest estimates of entity theories of intelligence was found among students in 10th grade. Further, an interaction effect involving Program x Time was also shown $F(4, 822) = 2.98, p < 0.05, \eta = 0.015$. For the Social Science Program (SSP) it did not matter which specific grade the students attended (10th, 11th or 12th), the preference for entity theories of intelligence was the same, but for the students on the Natural Science Program (NSP) there was a difference between the different grades. The students in 10th grade showed a lower rating of entity theories of intelligence compared to the students attending 11th grade and the students in 12th grade revealed the highest estimates of entity theories of intelligence. The students on the Aesthetic Subject Program (ASP) also differed dependent on which grade they attended but the estimates in grade 12 were substantially more pronounced at the NSP compared to the ASP.

For Incremental theories a main effect of Time spent at the program was found $F(2, 825) = 26.72, p < 0.001, \eta = 0.061$. Independent of which program the students attended, students in 10th grade reported higher incremental theories compared to those students attending 11th grade and the lowest ratings in incremental theories was found among students in 12th grade. No effects between programs were found for incremental theories.

Last a within-subject analysis showed $F(1, 819) = 185.08, p < 0.001, \eta = 0.184$ that incremental theories of intelligence dominated the students’ mind-sets significantly compared with entity theories of intelligence independent of grade or program.

**Achievement goals**

The three 3 x 3 between-subject ANOVAs in Table 3 present Performance Avoidance Goals concerning the students’ perception of their teachers, their classrooms and themselves in relation to the effect of type of program the student attend and time spent at the specific program.

Table 3. A 3 (SSP, NSP, ASP) x 3 (Grade 10th, 11th, 12th) between subjects ANOVA the dependent measures Teacher Avoidance Goal, Classroom Avoidance Goal and Personal Avoidance Goal. Means and standard deviations are displayed in the table below (N=765).

| Avoidance goal | Teacher | Classroom | Personal |
|----------------|---------|-----------|----------|
| SSP 10th (N=178) | 5.92 (2.19) | 4.07 (2.26) | 5.17 (2.50) |
| SSP 11th (N=99) | 4.79 (2.33) | 3.40 (1.86) | 4.43 (2.32) |
| SSP 12th (N=93) | 4.16 (1.91) | 4.02 (1.56) | 3.60 (2.12) |
| SSP Total (N=370) | 5.17 (2.28) | 3.88 (2.02) | 4.58 (2.44) |
| NSP 10th (N=88) | 5.64 (2.12) | 4.38 (2.34) | 4.97 (2.51) |
| NSP 11th (N=58) | 6.11 (1.79) | 4.55 (2.28) | 5.06 (2.51) |
| NSP 12th (N=65) | 5.14 (2.13) | 5.23 (1.53) | 5.11 (2.71) |
| NSP Total (N=211) | 5.62 (2.06)*** | 4.68 (2.15)*** | 5.04 (2.56)*** |
| ASP 10th (N=84) | 5.07 (2.08) | 3.21 (1.91) | 4.50 (2.27) |
| ASP 11th (N=55) | 4.83 (2.04) | 3.27 (2.22) | 4.08 (2.69) |
| ASP 12th (N=45) | 4.40 (2.26) | 4.02 (1.68) | 3.83 (2.28) |
| ASP Total (N=184) | 4.83 (2.12) | 3.42 (1.97) | 4.21 (2.41) |
| TOTAL 10th | 5.64 (2.17) | 3.94 (2.25) | 4.96 (2.46) |
| TOTAL 11th | 5.16 (2.19) | 3.68 (2.13) | 4.51 (2.48) |
| TOTAL 12th | 4.52 (2.10)*** | 4.41 (1.67)* | 4.13 (2.44)* |
| TOTAL | 5.21 (2.20) | 3.99 (2.09) | 4.62 (2.48) |

Note: SSP: Social Science Program, NSP: Natural Science Program, ASP: Aesthetic Subject Program, *$p < 0.05$, **$p < 0.01$ and ***$p < 0.001$. 
First the three main effects are presented where the NSP students differ in general from the students at SSP and ASP. The first main effect was found between the different programs on the dependent variable Teacher Avoidance Goals $F(2, 762) = 9.37, p < 0.001, \eta = 0.024$. The students at NSP reported higher avoidance goals in their perception of their teachers on the program compared to SSP and ASP students. A second main effect was found between the different programs on the dependent variable Classroom Avoidance Goals $F(2, 762) = 19.16, p < 0.001, \eta = 0.048$. The students at NSP reported higher avoidance goals compared to ASP and SSP students in their perception of their classroom. The third main effect of Program revealed on the dependent variable Personal Avoidance Goals was found $F(2, 762) = 7.31, p < 0.001, \eta = 0.019$. The students at NSP showed a higher preference for avoidance goals compared to the SSP and ASP students. In general the students at NSP reported higher Performance Avoidance Goals for all three measures.

One interaction effect was found between the different programs and which grade the students attended at the specific program on Teacher Avoidance Goals $F(2, 762) = 4.36, p < 0.01, \eta = 0.023$. The effect shows that Teacher Avoidance Goals are significantly lower among students at SSP and ASP in 12th grade at the program compared with students attending 10th grade. For the students at NSP no significant change was found.

Another significant interaction effect $F(2, 762) = 3.00, p < 0.05, \eta = 0.016$ was found for Personal Avoidance Goals between Program x Time. The students at SSP and ASP in 10th grade showed higher Personal Avoidance Goals compared to the students in 11th grade and the lowest ratings on the measure of avoidance goals was found among students in 12th grade. This is in contrast to NSP, where students in grade 10, 11 or 12 did not differ in their ratings of Personal Avoidance Goals.

The three 3 x 3 between-subject ANOVAs in Table 4 present Performance Approach Goals concerning the students’ perception of their teachers, their classrooms and themselves in relation to the type of program the student attend and time spent at the specific program.

Three main effects showed again that the students at NSP show different preferences in Performance Approach Goals compared to the other programs. A second main effect of program on the dependent variable Teacher Approach Goals was also found $F(2, 799) = 17.54$.

Table 4. A 3 (SSP, NSP, ASP) x 3 (Grade 10th, 11th, 12th) between subjects ANOVA on the dependent measures Teacher Approach Goal, Classroom Approach Goal and Personal Approach Goal. Means and standard deviations are displayed in the table below (N=802).

| Performance Approach | Teacher | Classroom | Personal |
|----------------------|---------|-----------|----------|
| SSP 10th (N=189)     | 2.40 (1.58) | 5.44 (2.27) | 4.07 (2.60) |
| SSP 11th (N=103)     | 2.20 (1.46) | 4.35 (1.92) | 3.54 (1.95) |
| SSP 12th (N=102)     | 3.42 (1.41) | 5.04 (1.46) | 4.59 (1.83) |
| SSP Total (N=394)    | 2.61 (1.58) | 5.05 (2.04) | 4.07 (2.29) |
| NSP 10th (N=91)      | 2.60 (1.88) | 6.03 (2.21) | 4.16 (2.34) |
| NSP 11th (N=59)      | 3.99 (2.21) | 6.64 (2.03) | 4.68 (2.32) |
| NSP 12th (N=66)      | 3.87 (1.89) | 6.25 (1.66) | 5.90 (1.84) |
| NSP Total (N=216)    | 3.37 (2.08)*** | 6.26 (2.02)*** | 4.83 (2.31)*** |
| ASP 10th (N=90)      | 1.98 (1.33) | 4.92 (2.04) | 3.62 (2.00) |
| ASP 11th (N=56)      | 2.21 (1.53) | 4.48 (2.31) | 3.54 (2.76) |
| ASP 12th (N=46)      | 3.92 (2.09) | 4.95 (1.49) | 4.73 (1.97) |
| ASP Total (N=192)    | 2.51 (1.78) | 4.80 (2.01) | 3.86 (2.28) |
| TOTAL 10th           | 2.35 (1.62) | 5.46 (2.23) | 3.98 (2.40) |
| TOTAL 11th           | 2.69 (1.88) | 5.00 (2.28) | 3.85 (2.33) |
| TOTAL 12th           | 3.67 (1.74)*** | 5.39 (1.63)*** | 5.02 (1.94)*** |
| TOTAL                | 2.79 (1.81) | 5.32 (2.11) | 4.22 (2.32) |

Note: SSP: Social Science Program, NSP: Natural Science Program, ASP: Aesthetic Subject Program, *p < 0.05, **p < 0.01 and ***p < 0.001.
Students at NSP indicated that their teachers favoured performance approach goals to a higher degree compared to SSP and ASP. A main effect of program on the dependent variable Classroom Approach Goals was found as well, $F(2, 799) = 37.98, p < 0.001, \eta^2 = 0.087$. Students at NSP reported higher performance approach goals within their classrooms compared to the students at SSP and ASP. A main effect was found on the dependent variable Personal Approach Goals on Program $F(2, 799) = 11.76, p < 0.001, \eta^2 = 0.029$, where the students at NSP reported higher approach goals compared to the students at SSP and ASP concerning the personal self. NSP reported higher Performance Approach Goals on all three measures compared to the students at SSP and ASP.

An interaction effect was found between the different programs and which grade (10th, 11th or 12th) the students attended on the dependent variable Personal Approach Goals $F(4, 797) = 4.33, p < 0.01, \eta^2 = 0.011$. The students in 12th grade at NSP reported the highest ratings of Personal Approach Goals compared to students in 11th or 10th grade. This effect is not present between different grades at SSP. Students attending 12th grade at ASP also reported higher ratings but this effect was not as stable as the one revealed at the NSP.

The three 3 x 3 between-subject ANOVAs in Table 5 present Mastery Goals concerning the students’ perception of their teachers, their classrooms and themselves in relation to the type of program the student attend and time spent at the specific program Table 5.

First two main effects are shown. The first was found between programs on the dependent variable Teacher Mastery Goals, $F(2, 794) = 6.31, p < 0.01, \eta^2 = 0.016$. It seems as though the students at SSP experience that their teachers foster mastery goals to a lower extent than the students at ASP. A second main effect was also found between programs for the dependent variable Classroom Mastery Goals, $F(2, 794) = 12.93, p < 0.001, \eta^2 = 0.032$. Here students at NSP reported higher Mastery Goals within their classrooms compared to the students at SSP.

Three main effects also emerged concerning Time spent at a program for all three Mastery goals; Teacher Mastery Goals, $F(2, 794) = 11.10, p < 0.001, \eta^2 = 0.027$.

### Table 5

| Mastery goal | Teacher | Classroom | Personal |
|--------------|---------|-----------|----------|
| SSP 10th (N=187) | 7.72 (1.96) | 7.34 (1.73) | 8.20 (1.78) |
| SSP 11th (N=103) | 6.91 (2.09) | 6.44 (1.58) | 7.10 (1.96) |
| SSP 12th (N=100) | 7.23 (1.58) | 5.75 (1.54) | 4.23 (1.67) |
| SSP Total (N=390) | 7.38 (1.93)** | 6.69 (1.77) | 6.90 (2.43) |
| NSP 10th (N=93) | 8.11 (1.72) | 7.77 (1.73) | 8.05 (2.16) |
| NSP 11th (N=59) | 8.09 (1.88) | 7.83 (1.93) | 8.33 (1.60) |
| NSP 12th (N=64) | 6.48 (1.49) | 6.11 (1.66) | 4.64 (1.87) |
| NSP Total (N=216) | 7.62 (1.85) | 7.30 (1.92)** | 7.11 (2.51) |
| EP 10th (N=89) | 8.05 (1.60) | 7.47 (1.44) | 7.64 (1.92) |
| EP 11th (N=56) | 7.66 (1.89) | 7.17 (1.77) | 7.74 (2.01) |
| EP 12th (N=46) | 7.88 (1.55) | 5.96 (1.42) | 4.17 (1.85) |
| EP Total (N=191) | 7.90 (1.67) | 7.02 (1.65) | 6.83 (2.44) |
| TOTAL 10th | 7.89 (1.83) | 7.48 (1.67) | 8.03 (1.92) |
| TOTAL 11th | 7.42 (2.04) | 7.00 (1.82) | 7.60 (1.94) |
| TOTAL 12th | 7.14 (1.62)** | 5.90 (1.55)** | 4.34 (1.77)** |
| TOTAL | 7.57 (1.86) | 6.93 (1.80) | 6.94 (2.45) |

Note: SSP: Social Science Program, NSP: Natural Science Program, ASP: Aesthetic Subject Program, *p < 0.05, **p < 0.01 and ***p < 0.001.
Classroom Mastery Goals, $F(2, 794) = 56.66, p < 0.001, \eta = 0.126$, and finally Personal Mastery Goals, $F(2, 794) = 249.84, p < 0.001, \eta = 0.388$. The students had significantly lower mastery goals on all three programs in the third year. No other differences were found.

**Discussion**

This study aimed to examine whether different disciplinary programs, more specifically the Swedish upper-secondary school Natural Science Program, Social Science Program and Aesthetic Subjects Program, exert influence on students’ implicit theories of intelligence and their achievement goals.

According to our first hypothesis the students’ in 12\(^{th}\) grade from NSP reported higher entity theories compared to the students in 10\(^{th}\) grade, whilst the students at SSP did not differ in their beliefs about intelligence as fixed dependent on grade. The ASP students also reported higher entity theories of intelligence in 12\(^{th}\) and 11\(^{th}\) grade compared to students attending 10\(^{th}\) grade, but this effect was not as large as the one present at NSP. It is important to notice that the students at NSP did not differ in 10\(^{th}\) grade at their program from their fellow students at SSP and ASP in their beliefs about intelligence.

It is suggested that western societies have a tradition of viewing math ability as something fixed and inherited (Williams & King, 1980). Individuals within the context of the mathematical discipline explain failures with for example statements such as ‘I’m not a math person’. Good, Rattan and Dweck (2012) also point out that beliefs in the fixed and inherited nature of intelligence are more present within the discipline of mathematics than in any other subject. Jonsson et al. (2012) found that teachers in upper-secondary school differed in that the teachers in mathematics favoured entity theories of intelligence to a higher level than for example social science teachers and supported incremental theories of intelligence to a lower level.

The results from the present study confirm these patterns. It seems as if the students at the NSP, who are exposed to more mathematics and related subjects, are more cultivated into the beliefs that intelligence is fixed and unchangeable. One can only speculate at this moment about how this adaption toward entity theories among the students at the NSP is regulated within the specific program. Rattan et al. (2012) proved that instructors in math with stronger entity theories of intelligence preferred to use more feedback in order to comfort students for their perceived “low ability” in math. Moreover, research seems to present more and more evidence that shows that teachers in mathematics and science have weaker beliefs in students’ abilities to develop and improve their intelligence compared to teachers in for example social science (Jonsson et al., 2012). Teachers favouring an entity theory of intelligence were in general involved in pedagogical practices that could decrease motivation in the mathematic discipline compared to those who rated highly on incremental theories (Masclet et al., 2015; Rattan et al., 2012). It matters which view the student adopts. An incremental view of intelligence promotes motivation, learning and achievement whilst an entity view does not (Blackwell et al., 2007; Carr & Dweck, 2011; Dweck, 1999).

In addition to the above the results also show that entity theories of intelligence in general had increased in 12\(^{th}\) grade compared to 10\(^{th}\) grade. These results confirm
findings by Anderman et al. (2002), where entity theories were strengthened during upper-secondary school and incremental theories were weakened. At the same time the Swedish students’ mind-sets were irrespectively of grade significantly dominated by incremental theories compared to entity theories of intelligence.

Our second hypothesis concerned the influence of the different programs on the students’ achievement goal orientation. Dweck (1986; 1999) argued that those believing intelligence to be fixed adopt performance goals and those with stronger beliefs in intelligence as malleable adopt mastery goals. If the achievement goals show the same pattern as the implicit theories of intelligence, this would underpin our assumptions. The question was whether weaker mastery goals and stronger performance goals could be found among the students in 12th grade at the NSP in comparison to the students at SSP or ASP compared to 10th and/or 11th grade.

The students from NSP reported significantly higher performance avoidance as well as performance approach goals compared to the other two programs in general. Tuominen-Soini et al. (2012) results showed that avoidance oriented students in upper-secondary school have less adaptive patterns of motivation and lower wellbeing compared to master oriented students. An interaction effect showed that the students in 12th grade at NSP reported higher Personal Approach Goals compared to students in 10th grade whilst the students at SSP did not differ depending on which grade they attended.

According to Urdan and Mestas (2006) performance goals (both avoidance and approach) involve a concern about ability in competitive terms. Here the teachers’ practices are important as the norms implemented by the teacher influence the students’ perception of goal structure (Wolters, 2004). From this research our results would suggest that there is a greater focus on social comparison and competition between students at the NSP compared to the other two programs.

It is an interesting result that performance goals are significantly more present at the NSP in 12th grade compared with the SSP and ASP, because also entity theories of intelligence at NSP in 12th grade were higher compared to 10th and 11th. This difference between the initial year at the program and the last was not present at SSP. However, at the same time the students at NSP also reported higher mastery goals in the classroom compared to the students at SSP, suggesting therefore that it is possible to have high performance goals and high mastery goals simultaneously. This is a question of dimensionality within the concept of achievement goal that Niemivirta (2002) has approached with colleges. In relation to this Tuominen-Soini et al. (2012) could conclude that competing preferences in achievement goals among upper-secondary students are “...common among adolescents especially in a school context where students seek to both follow personal interests and respond to external demands.” (p. 300). Our investigation confirms this result.

According to Anderman and Wolters, (2006), Maehr and Midgley (1996), Urdan, Midgley and Anderman (1998) and Wolters (2004) the students’ choice of goal orientation is influenced by the teachers’ rules, norms and routines. The students at the Natural Science Program differed from the other students when it came to their preference of implicit theories of intelligence and goal orientation. We suggest because of this that there may be problems within the discipline of mathematics in line with Good et al. (2012), Beach (2003), Masclet et al. (2015) and Rattan et al. (2012) at the Swedish upper-secondary school. Society needs to recruit creative and skilled students
to higher education within natural science. When growth within mathematics is inhabited by naïve beliefs about intelligence as fixed an innate and achievement goals that do not promote learning we may need to do something about it if the quest for creativity in science is to be fulfilled.

**Limitations and future research**

There are several limitations in this study. Most importantly only one upper-secondary school in a specific country has been included in the study. The problems of statistical generalisation are therefore limited. Secondly, the population of students included in the study are all attending academic, theoretical programs that are preparing for higher education. We do not know how the results would be if the study had been performed at a vocational upper-secondary school. Thirdly, different instruments are used at the international scientific arena that might give alternative perspectives on the topic of achievement goals compared to PALS (Midgley et al., 1998, 2000). One of these is the multi-dimensional person-centred approach (Niemivirta, 2002; Tuominen-Soini et al., 2012). This could be of importance to consider because the current study showed low Cronbach alpha for some of the items from the PALS questionnaire, teacher performance avoidance and approach goals and classroom mastery goals, that limits the interpretation of the results from these specific measures. However, having said all of this our main interest was for effects of concepts of intelligence on learning in specific contexts. We have not set out to generalise beyond this and nor do we try to do so. What we have identified are interesting developments from a local and highly controlled and familiar context for further investigation also in others. This is we feel a very valuable contribution.

**Conclusions**

In this study entity theories of intelligence were the same the first year in upper-secondary school independent of which program the students attended. The last year the students at Natural Science Program reported significantly higher entity theories compared with students at Social Science and Aesthetic Subject Programs. Even if the incremental theories of intelligence dominated the students’ mind-sets in each grade, they were significantly less pronounced in 12th grade compared to 11th and 10th grade, which is a serious problem for upper-secondary school to approach. Natural Science Program students also showed a stronger focus on both performance avoidance and performance approach goal orientations compared with students from Social Science and Aesthetic Subject Programs. Society has chosen to lift mathematics as the most important ability and has at the same time chosen to believe it to be fixed and inherited (Good et al., 2012; Mascret et al., 2015; Williams & King, 1980). The problem in this is that beliefs about math ability as fixed, as something you have or do not have, may be lowering the motivation and by this, decrease achievement in math among our students (Blackwell et al., 2007; Blackwell et al., 2015; Carr & Dweck, 2011). The dipping performance in math is by now well-known and not only a problem for Sweden. In accordance with the results from this
study, we suggest that it might be very important to stimulate incremental theories of intelligence among students as well as teachers. Important research by Blackwell et al. (2007), Boaler (2016) and Dweck (1999) has shown that it is possible to create patterns of feedback and interplay in classrooms that stimulate achievement goals that increase their motivation, promote the learning processes and encourage students to believe that ability can be improved by effort.

Note

1. The distribution of the brief contextualized ITI questionnaires were for social science N = 300 (Cronbach alpha were .700 for an entity theory and .874 for an incremental theory) and for math N = 538 (Cronbach alpha were .784 for an entity theory and .847 for an incremental theory). They were proportionally distributed within classroom/program/grade.

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**Appendix 1**

*Theories of Intelligence Scale – Self Form (Dweck, 1999)*

The scale is designed by Carol Dweck in order to investigate ideas about intelligence. We chose to use the “Self Form” of the scale and not “Others Form” that concerns how people judge others. The items were translated to Swedish in 2007 and have proved to be reliable in several earlier studies (Jonsson & Beach, 2010; Jonsson & Beach, 2012; Jonsson, Beach, Korp & Erlandson, 2012). The participants rated the 8 items, 4 entity and 4 incremental items that were randomised in the full questionnaire. We used a 10 point numerical scale where 1 = Strongly disagree and 10 = Strongly agree.

1. You have a certain amount of intelligence, and you can’t really do much to change it.
2. Your intelligence is something about you that you can’t change very much.
3. No matter who you are, you can significantly change your intelligence level.
4. To be honest, you can’t really change how intelligent you are.
5. You can always substantially change how intelligent you are.
6. You can learn new things, but you can’t really change your basic intelligence.
7. No matter how much intelligence you have, you can always change it quite a bit.
8. You can change even your basic intelligence level considerably.
Appendix 2

PALS – Pattern of Adaptive Learning Scale (Midgley, Maehr, Hruda, Anderman, Anderman, Freeman, Gheen, Kaplan, Kumar, Middleton, Nelson, Roeser & Urdan, 2000)

The PALS scale is designed by Midgley et al. (2000) in order to measure achievement goal orientation. 27 items from PALS were translated to Swedish and rated by the participants, please see below for the exact items and their distribution for personal, teacher and classroom achievement goals. We used a 10 point numerical scale where 1 = Strongly disagree and 10 = Strongly agree.

Personal Achievement Goal Orientation
Mastery Goal Orientation

(1) It’s important to me that I learn a lot of new concepts this year.
(2) It’s important to me that I thoroughly understand my class work.
(3) It’s important to me that I improve my skills this year.

Performance-Approach Goal Orientation

(1) It’s important to me that other students in my class think I am good at my class work.
(2) One of my goals is to show others that class work is easy for me.
(3) One of my goals is to look smart in comparison to the other students in my class.

Performance-Avoid Goal Orientation

(1) It’s important to me that I don’t look stupid in class.
(2) It’s important to me that my teacher doesn’t think that I know less than others in class.
(3) One of my goals in class is to avoid looking like I have trouble doing the work.

Perception of Teacher’s Goals
Teacher Mastery Goal

(1) My teacher thinks mistakes are okay as long as we are learning.
(2) My teacher wants us to understand our work, not just memorize it.
(3) My teacher really wants us to enjoy learning new things.

Teacher Performance-Approach Goal

(1) My teacher points out those students who get good grades as an example to all of us.
(2) My teacher lets us know which students get the highest scores on a test.
(3) My teacher tells us how we compare to other students.

Teacher Performance-Avoidance Goal

(1) My teacher says that showing others that we are not bad at class work should be our goal.
(2) My teacher tells us it’s important to join in discussions and answer questions so it doesn’t look like we can’t do the work.
(3) My teacher tells us it’s important to answer questions in class, so it doesn’t look like we can’t do the work.
Perception of Classroom Goal Structures
Classroom Mastery Goal Structure

(1) In our class, it’s important to understand the work, not just memorize it.
(2) In our class, learning new ideas and concepts is very important.
(3) In our class, it’s OK to make mistakes as long as you are learning.

Classroom Performance-Approach Goal Structure

(1) In our class, getting good grades is the main goal.
(2) In our class, getting right answers is very important.
(3) In our class, it’s important to get high scores on tests.

Classroom Performance-Avoid Goal Structure

(1) In our class, it’s important not to do worse than other students.
(2) In our class, it’s very important no to look dumb.
(3) In our class, one of the main goals is to avoid looking like you can’t do the work.