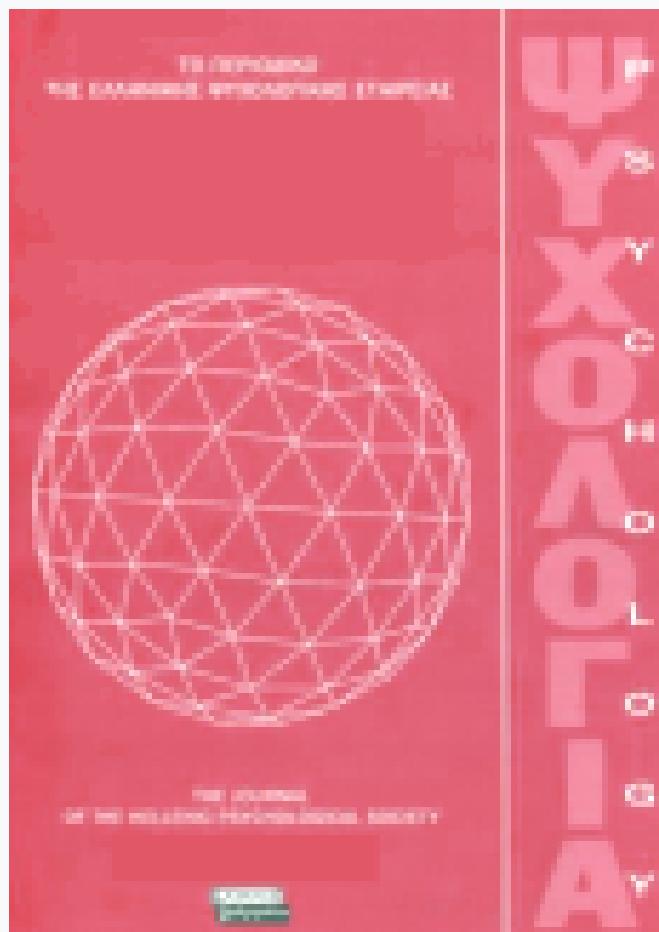


Psychology: the Journal of the Hellenic Psychological Society

Vol 7, No 3 (2000)



Gender differences in the development of academic self-concept of attainment from the 2nd to the 6th grade: Relations with achievement and perceived motivational orientation

Janne Lepola, Marja Vauras, Hanna Maki

doi: [10.12681/psy_hps.24272](https://doi.org/10.12681/psy_hps.24272)

Copyright © 2020, Janne Lepola, Marja Vauras, Hanna Maki



This work is licensed under a [Creative Commons Attribution-ShareAlike 4.0](https://creativecommons.org/licenses/by-sa/4.0/).

To cite this article:

Lepola, J., Vauras, M., & Maki, H. (2020). Gender differences in the development of academic self-concept of attainment from the 2nd to the 6th grade: Relations with achievement and perceived motivational orientation. *Psychology: The Journal of the Hellenic Psychological Society*, 7(3), 290–308. https://doi.org/10.12681/psy_hps.24272

Gender differences in the development of academic self-concept of attainment from the 2nd to the 6th grade: Relations with achievement and perceived motivational orientation

JANNE LEPOLA, MARJA VAURAS, & HANNA MÄKI

University of Turku, Finland

ABSTRACT

The aims of this study were, first, to examine gender differences in the development of math, reading and writing self-concept of attainment (SCA) from grade 2 to grade 6, and, second, to investigate the relationships between self-concept and academic achievements, and self-concept and motivation. The longitudinal sample included 101 Finnish students. Students' SCAs were assessed in the 2nd, 3rd and 6th grades, and word reading, spelling and math skills were diagnosed in the 2nd and 3rd grades. Teacher reports of students' motivational orientations and school marks were obtained in the 3rd and 6th grades. The ANOVAs showed that self-concept decreased drastically along with age, reflecting an age-related optimism in grade 2 and realism in grade 6. Substantial gender differences were found in favour of boys in math SCA and in favour of girls in writing SCA. The strength of association increased from the 2nd to the 6th grade between SCA and school achievement as well as with motivational orientations. Task orientation was positively and non-task orientations were negatively related with the domains of SCA. The finding that boys and girls with equally low motivation-achievement pattern showed distinctive math SCA suggests that the subjective experience of math ability is related differently to external evaluation and perceived motivational tendencies in girls and boys.

Key words: Motivational orientation, Primary school students, Self-concept of attainment.

Introduction

Regarding the formation and change of self-perceptions, one meaningful source of information for a student about his or her actual competence in classroom is social comparison. According to Festinger (1954), when there is no unambiguous criteria for ability and performance available, people look to other individuals for subjective standards (Ruble, Grosovsky, Frey, & Cohen, 1992). The formation of self-perceptions of competence during the primary school grades

has been studied mainly from two perspectives: either from the cognitive-developmental point of view, which focuses on students' self-construction processes (Ruble et al., 1992) or from more sociological considerations based on the construction and formulation (Waterhouse, 1991) of the person in a social context through the influence of significant others, such as peers and teacher (for a review, see Rosenthal & Simpson, 1984).

The aims of this study were to examine gender differences in the development of

reading, writing and mathematics self-concepts, and to investigate the changes in the relations of students' relative self-ranking within the class with his or her actual achievements and motivation. Moreover, we were interested in how these two perception levels (i.e., teacher's *motivational ratings* based on students' task performance and *marks* based on school achievement and student's own relative academic self-perceptions) are related developmentally.

Competence assessments during primary school years: Age and gender differences

Several studies have examined developmental changes concerning children's self-concept of attainment (SCA) and the relationships of academic self-concept and academic achievements during the primary grades (Chapman & Tunmer, 1997; Helmke, 1997; Helmke & van Aken, 1995; Marsh, Craven, & Debus, 1998). Research on the development of the accuracy of self-estimations relative to classmates has shown that young children tend to equate effort with ability, which leads them to overestimate their actual skills (Nicholls, 1978). However, with age and practice at school, students tend to change their overly optimistic self-evaluations to more realistic perceptions and thus be in line with their actual achievements (Helmke, 1997). Furthermore, it has been found that students' ability to judge their abilities accurately is not only a matter of gender, age or school practice, but is also related to cognitive development (Bouffard, Markovits, Vezeau, Boisvert, & Dumas, 1988), ethnic background (Blatchford, 1997), and ego- vs. task orientation (Martin & Debus, 1998) of the respondent. A study by Nicholls (1978) showed that children's estimates of their own position in a class begin to correlate significantly to teacher ratings of students' achievement from the age of 9 years (i.e., 3rd grade in Finland) onwards: the highest consensus of rank position between the student

and the teacher emerged at the age of 12.

Correlational findings indicate a growing awareness and use of social comparison processes in self-perception with age. However, young children are found to use social comparison information when evaluating peers' performance, but they use less external standards when evaluating themselves (Ruble et al., 1992). What is then needed to rank accurately one's own place in class? Nicholls (1978) suggested that a child's "ability" to rank [their] own attainment accurately depends on *ability to seriate*, to see one's position from the viewpoint of an observer outside one's group, and to relate temporally separated outcomes to each other". Accordingly, it is suggested that a student's self-concept of attainment is formed inevitably through social comparison processes present in classroom interaction during primary grades. As a function of these comparisons, a student's self-rankings indicate *perceived success or failure* in relation to classmates. Studies which have used the Nicholls Scale are mainly focused on mathematics and reading SCA. We also assessed student's writing SCA, since writing skills seem to be an academic field where Finnish boys are over-represented among poor performers at least until the 3rd grade (Mäki, Voeten, & Vauras, 1998).

Gender differences. Stipek and Gralinski (1991) examined 3rd graders' and secondary school students' achievement-related beliefs as a function of gender. They found that girls rate their competence in maths lower than boys, attribute success to ability significantly less frequently than boys and failure to lack of ability more often than boys did. In addition, concerning future expectations and motivated behavior toward maths, girls tend to believe that effort does not necessarily lead to success, whereas boys showed higher expectations and less desire to avoid mathematics than girls. These findings suggest that girls' attributional patterns to failure in mathematics do not facilitate mathematics learning, and, moreover, these patterns decrease

the likelihood of continuing in maths studies. Also Eccles, Wigfield, Harold, and Blumenfeld (1993) found clear differences in academic competence perceptions and subjective task values between boys and girls during the primary grades: boys showed significantly higher competence beliefs for mathematics than girls, and valued reading less than girls. Helmke (1997) has reported systematic gender differences in favour of boys in self-concept of attainment in maths as well as in the degree of liking maths from 2nd to the 4th grade. Consistent findings about boys' higher self-concept in mathematics and higher self-perceived skills in maths than girls have been found amongst 6th and 9th graders, even though differences in students' achievement levels were controlled (Skaalvik & Rankin, 1994). The gender differences do not only emerge in expectations but they also emerge in relation to intellectual achievement behaviors. Crandall, Katkowsky, and Preston (1962) have shown that motivational factors, such as *expectations of intellectual success and degree of self- vs. other-responsibility for achievement*, were positively and significantly related with boys' intelligence, reading and arithmetic test performances, while those factors were either negatively or non-significantly related to girls' intellectual performance. The above findings indicate that well known gender-related expectations about maths as a male domain and verbal ability as a female domain are based not only on stereotypes but they also exist early as an obdurate reality in children's beliefs about their competence.

Academic self-concept from an achievement perspective

Correlations have been reported in several studies between maths and reading SCA and actual school achievement, respectively. A German longitudinal study from grade 2 to grade

4 found correlations of .35, .40, and .52, between maths SCA and marks in mathematics, and correlations of .36, .38, and .50, between maths SCA and maths test results (Helmke, 1997). Specifically, higher concurrent correlation emerged between an overall maths self-evaluation and maths marks than between more specific maths SCA and achievement in maths (Helmke & van Aken, 1995). A similar increasing trend of correlations between both SCA and marks and SCA and spelling skills was found (Helmke, 1997). Kurtz-Costes and Schneider (1994) reported a correlation of .31 in the 2nd and a correlation of .48 in the 4th grade between reading SCA and official grades, whereas in mathematics the relationship was much stronger in the 4th grade, ($r = .79$). Regarding the associations in boys and in girls from the 4th to the 5th grade, Muijs (1997) reported that correlations were higher for boys than for girls between the maths and language self-concept and school achievement; however, a gender-based difference emerged in the relation of general self-esteem and achievement, showing a correlation of .35 for boys and .20 for girls.

Self-concept and motivation: The role of teacher perceptions

Children's perceptions of their own ability and competence within class at school are found to influence expectations and emotions, which in turn affect motivation (Eccles & Wigfield, 1985; Harter, 1992). Motivational orientations which focus on reasons and goals of students' learning efforts have been found to affect students' achievement careers (Nolen, 1988; Salonen, Lepola, & Niemi, 1998). Regarding the developmental interaction of motivation and self-competence, Harter (1992) reported that students, whose perception of competence increased from junior to high school, displayed also progressive intrinsic motivation, whereas an opposite motivational pattern was found in children with

lowering self-competence. Lehtinen, Vauras, Salonen, Olkinuora, and Kinnunen (1995) found in a follow-up case-analysis both substantial changes and stability in SCA. A realistic and also optimistic academic self-concept was associated with a progressive learning career and task-oriented coping with school tasks as well as a strong sense of control both on intellectual and social aspects of learning. Whereas an unrealistic academic self-concept was related to regressive coping strategies, such as intensive manifestation of both ego-defensive and social dependence type of behaviors.

In addition to the factors above, a primary school teacher's behavior involving multiple roles such as facilitator of learning, evaluator, classroom manager and discipline controller may influence students' perception of ability. Teacher expectancy literature (Brophy, 1983) has shown that teachers' differential expectations have, statistically, a marginal contribution to students' achievement, but may nevertheless be critical (cf., Rosenthal, 1985) in either encouraging or discouraging the student's self-confidence to future task-accomplishments. In this study we set the question in which grade does a teacher's perception of a student's motivation start to reflect in that student's self-perception of his or her academic attainments, and are these relations qualified by gender?

The interactionist constructs of *motivational orientations*, that is, task, ego-defensive and social dependency (Olkinuora & Salonen, 1992) were used as an indicator of the teacher's perception of students' motivation. There exists considerable evidence that this model of motivational orientation, based on a student's task adaptations by means of coping responses, accounts for the social-cognitive foundations of either progressive or regressive learning careers (Lehtinen et al., 1995; Salonen, Lepola, & Niemi, 1998). On the basis of recent theoretical elaboration of the relations between student, teacher and learning task it has been suggested that student's orientation towards the task is

dependent on the teacher's own motives and needs to sustain the social and cognitive balance (Salonen, Lehtinen, & Olkinuora, 1998). But how are motivational orientations related to a student's SCA developmentally?

Research questions

This study aimed, firstly, at tracing the development of boys' and girls' academic self-concept from the 2nd to the 6th grade in the domains of reading, writing and mathematics. Secondly, we set out to examine gender differences on the strength of the relationships between self-concept of attainment (namely, reading, writing and math) and the respective cognitive skills (i.e., in word reading, spelling and mathematics). Thirdly, we wanted to unravel the developmental changes in the conformity of teacher's and student's perceptions. To do this we analysed the relation between school marks, students' motivation reported by the teacher, and students' report of their self-concept of attainment. Accordingly, we sought to answer the following questions:

- 1) How do boys' and girls' self-perceptions of attainment develop in reading, writing and mathematics from the 2nd to the 6th grade?
- 2) Are there gender differences in relation to reading, writing and maths self-concept and actual cognitive achievement in word reading, spelling and mathematics skills in the 2nd and 3rd grade?
- 3) How are teacher's ratings of student motivation and his/her marks given to the student related to each other and to the students' own self-concept of attainment? Specifically, we were interested in whether these relations are qualified by gender and how these relations change with age from grade 3 to grade 6.

On the basis of the research evidence presented above, we assumed that students' self-concept of attainment decreases from the 2nd to the 6th grade, being more commensurable with their actual school achievement

at the end of the primary school. We expected to find rather low correlations between actual cognitive skills and self-concept in the 2nd and 3rd grade, while the correlation between marks and SCA should be higher and increase from the 3rd to 6th grade. In addition, we hypothesised that boys and girls should display differential developmental pattern in their maths, reading and writing self-concept of attainment.

Regarding the strength of relations between teacher perception of student motivational orientations and student self-concept of attainment, the associations were expected to increase over years. In addition, we assumed that the higher the student's task orientation the better academic self-concept he or she will show, whereas the higher the teacher-perceived ego-defensive or/and social dependency orientations are, the lower academic self-concept student will display. Developmentally, we predicted that during early elementary grades these relations of *motivational factors* evaluated by the teacher and student *self-perception of competence* should be weak, and the relation should increase in strength as students receive more formal and comparative feedback from teachers and peers, such as marks given from the 3rd grade onwards.

Method

Participants

The final longitudinal sample used in the analyses of the development of self-concept included 101 children, 51 girls and 50 boys. The sample size varied slightly across measures because of variations in missing data. However, none of the comparisons yielded significant differences when comparing the mean scores of all students available and the longitudinal sample on each measurement point. Participants were drawn from three primary schools from urban districts around Turku, Finland. Data collection

was repeated annually during the spring terms in the second, third and sixth grade, when the children were 8, 9, and 12 years old.

Tests and procedure

Self-concept of attainment (SCA). Self-concept of attainments in each domain, i.e., reading, maths and writing, were assessed during the 2nd, 3rd, and 6th grade. Children were presented with a sheet of paper with 25 schematic circles (each one described one student of the class) in a vertical line from top to bottom of the page. We added 5 more circles to the rating scale (i.e., from 1 to 30) at the 6th grade because the sizes of classes had increased since the 3rd grade. The experimenter explained carefully to every student that the circles represented the children in their class. The one at the top (along with number '1') represented a student who did best at reading / writing / maths and so on to the worst performer (along with number '25'). Checks were made that the students correctly understood the procedure and the idea of circles of high, intermediate and low performers, before being asked "Now show me what is your place within your class? Which one is you?" for reading, writing, and maths, respectively (see, Nicholls, 1978). The SCA test was administered individually at the 2nd and 3rd grades and a classroom test was given in the 6th grade.

The scoring system for the SCA measures.

The raw scores of self-concept of attainment were used when computing concurrent correlations between the reading, writing and maths domains of SCA, actual cognitive and school achievement and perceived motivation. For the purpose of developmental analysis we rescaled every item of children's judgement of their relative standing in classroom into five categories from (5) very good to (1) very low. This was done since the range of rating scales differed in the 3rd and 6th grades.

Teacher perceptions of student's moti-

vational orientation. Each of the three motivational orientations, i.e., task, ego-defensive and social dependence orientation, was assessed during the spring terms of the 3rd and 6th grades. The behavioral modes describing each orientation were rated on three to four five-point Likert-type subscales by the teacher who had thorough experience of each student in his/her class. Teachers had several weeks to assess the motivational orientation of each child on the basis of detailed clarifications and examples. The Task Orientation items addressed concentration on task in spite of external disturbances, verbal behavior indicating task involvement, willingness to think and experiment in play and problem-solving situations, and persistence in task performance. Social dependence orientation items consisted of verbal help seeking indicating helplessness, imitative behavior, compliance-type task-approaching behavior, and tracking of verbal cues (e.g., "the student is instantly seeking help for task performance after the teacher's instruction or is experiencing slight difficulties as shown in verbal cues or is looking helpless"). Ego-defensive orientation items referred to avoidance behavior, inhibition of action, and negative self- or performance-related utterances (e.g., "the student displays signs of passive- or/and inhibited modes of behavior such as desperate staring, "freezing" or "sighing deeply"). The same items were used on every assessment point. As an index of the intensity of each motivational orientation, the scores of the items of each orientation were first aggregated and then divided by the number of items. Thus the range for each

orientation was from 1 (very low) to 5 (very high). Cronbach's alpha for the items tapping task, ego-defensive and social dependence orientations at the 3rd and 6th grade are given in Table 1.

The data concerning the perception of students' motivational orientation was based on 7 third grade and 6 sixth grade teachers' ratings. Five out of these six teachers had the same class from the 3rd to the 6th grade.

Word reading skill. To assess students' word reading (i.e., decoding) skill, a measure of text reading time was derived from a 95-word test administered during the spring terms of the 2nd and 3rd grade. The children were asked to firstly read the text aloud and then read it in silence at their own pace. The experimenter timed and recorded the passage that was read aloud.

Spelling skill. Spelling was evaluated on the basis of text produced in the narrative writing task in the 2nd and 3rd grades. A composite score of all spelling errors per word was computed. Spelling errors were small in both grades since errors were counted per word (in detail, see Mäki, Voeten, & Vauras, 1998).

Arithmetic and word problem solving skills. To assess students' achievement in mathematics classroom tests were administered during the spring terms in the 2nd and 3rd grade. The second grade maths test included 15 subtests of basic arithmetic skills, such as addition, subtraction, and multiplication, as well as 12 tasks requiring the solution of word problem tasks (e.g., "Ville gave 4 sweets to Tommi. Ville now has 3 sweets. How many sweets did Ville have in the beginning?"). The sum score of arithmetic

Table 1
Item analysis of motivational orientations

Motivational orientation items	Third grade	Sixth grade
Task orientation (4 items)	a = .70	a = .87
Ego-defensive (3 items)	a = .83	a = .76
Social dependence (4 items)	a = .74	a = .76

and verbal word problems was used in data analyses. The maximum score was 27. The *third grade* maths achievement assessment comprised of two subtests of *arithmetic skills*, one presented verbally by the experimenter, and another arithmetic test presented on a sheet of paper (eight items: e.g., "332 + 17 + 6 = ?, 4 x 6 = ?"). In addition, *eight word problems*, one-, two- and three-step types of tasks, were presented (e.g., Two-steps: "Jukka picked up 13 apples. He picked 5 apples more than Petri. How many apples did they pick up together?"). The maximum score was 28 (in detail, see Vauras, Hannula, Kinnunen, Kajamies, & DeCorte, 1998).

Official school marks. Official marks in mathematics and Finnish provided by the teacher at the end of the 3rd and 6th school year were used. In Finland the scale for school marks ranges from 4 to 10.

Gender differences were examined in

mathematics, word reading and spelling skills in the 2nd and 3rd grade. In addition, we analysed gender differences in school marks.

As Table 2 shows, with an alpha level of .01, the gender difference was statistically significant in *mathematics* at the end of the 3rd grade. There were no statistical differences between boys and girls in *word reading skill* in either the 2nd or in the 3rd grade. In *spelling skill*, girls outperformed boys in the 2nd grade, but that difference vanished in the 3rd grade. This picture is compounded by the floor effect of the 3rd grade spelling test indicating that early difficulties in spelling were almost beaten (cf., Mäki, Voeten, & Vauras, 1998). Concerning gender differences in marks, boys had significantly higher marks in maths both in the 3rd and 6th grades, whereas girls showed higher grades in Finnish in the 6th grade, reinforcing the expectations of gender-role stereotypes of maths as a male, and verbal as a female domain.

Table 2
Gender differences in mathematics, word reading and spelling skills and school marks

Variables	Boys (n=51)		Girls (n=50)		F
	M	SD	M	SD	
Second grade					
Maths skills	22.40	4.26	20.39	4.23	5.630*
Word reading skills ^a	133	58	152	73	1.900
Spelling skills (errors/word)	.19	.24	.13	.13	2.830
Third grade					
Maths skills	23.52	4.05	20.49	4.96	11.250**
Word reading skills	105	36	105	38	.001
Spelling skills (errors/word)	.09	.10	.06	.08	2.200
Third grade, marks					
Finnish	8.10	.89	8.14	.83	.050
Mathematics	8.60	.88	8.12	.91	7.330**
Sixth grade, marks (n = 90)					
Finnish	7.91	.92	8.36	.91	5.290*
Mathematics	8.56	1.12	7.96	1.36	5.200*

Note: * $p < .05$, ** $p < .01$; a: text reading time in seconds.

Results

Developmental changes in self-concept of attainment

To address the first question concerning gender differences in academic self-perceptions, we performed $2 \times 3 \times 3$ (Gender x The domain of SCA x grade) ANOVAs for self-concept of attainment (SCA). The main effects of the domains of maths, reading and writing SCA, $F(2, 198) = 7.43, p < .001$, and grade, $F(2, 198) = 11.18, p < .001$, were significant. In addition, a Gender x Domain of SCA interaction effect was found, $F(2, 198) = 14.68, p < .001$. These analyses indicated that the relative self-ranking in the domain of writing SCA was lower than in reading and maths SCA measures, and the mean-level of self-concept of attainment decreased over time in each domain from 2nd to the 6th grade, suggesting that students bring their relative self-

perceptions of academic ability more in line with their actual position in their class. The younger students showed less variance than older students in all SCA domains. This greater variance of older student reflects the realism which is based on the actual dispersion of their competence in the classroom. Moreover, boys displayed higher maths SCA and lower writing SCA than girls over these four primary school years. Post hoc (Tukey HSD) analysis revealed that girls' maths self-concept of attainment was significantly lower than boys' in the 3rd and 6th grades, whereas the reverse pattern was found in writing SCA in the 6th grade. In reading SCA, no significant gender differences were found over the years (see Figure 1).

Planned contrasts analyses were carried out within each gender to compare the estimates of each domain of SCA. Significant differences were found for the sample of boys between maths and writing SCA, $F(1, 99) = 25.05, p < .001$, and

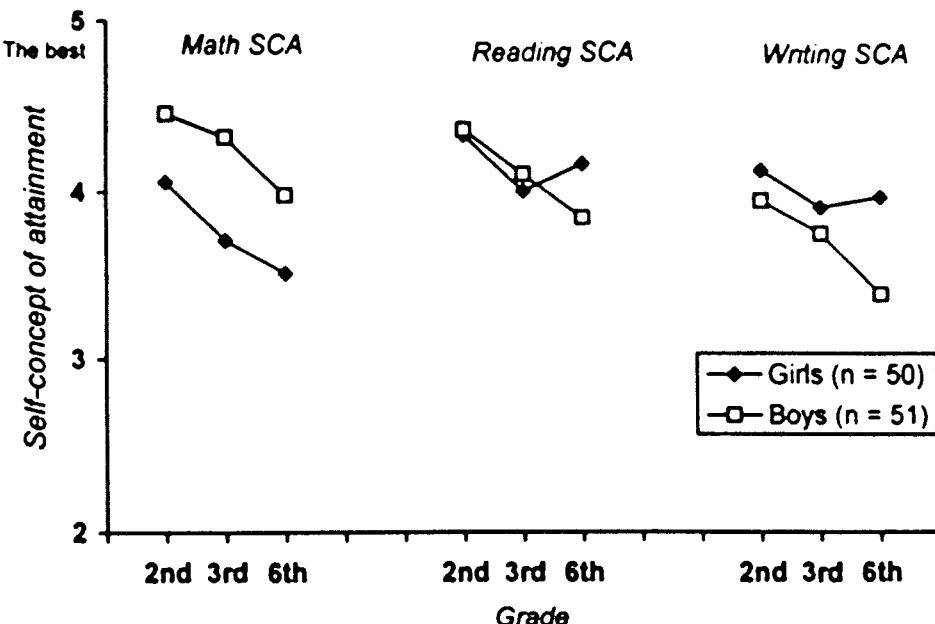


Figure 1: The development of boys' and girls' maths, reading, and writing self-concept of attainment

between reading and writing SCA, $F(1, 99) = 17.38, p < .001$. On the other hand, girls showed significantly higher in writing than in maths SCA, $F(1, 99) = 25.05, p < .001$, and also higher in reading than in maths SCA over the years, $F(1, 99) = 13.69, p < .001$.

The question whether or not the gender differences in 3rd grade maths SCA were larger than could be explained by differences in actual maths skills (test score of arithmetic and word problems), was tested by analysis of covariance. One-way ANCOVA for math SCA between gender with maths skills as covariate variable revealed significant main effect for gender, $F(1, 98) = 4.96, p < .05$, after controlling differences in students' actual maths skills. This underscores the role of not only the skill-based but also the gender-based factors in the rating of the self in maths.

Achievement, perceived motivation and self-concept of attainment: Correlational analysis

In the first section, concurrent correlations

were computed between cognitive skills (i.e., word reading, mathematics, spelling) and the domains of self-concept for all students and for boys and girls separately. In the second section, the strength of relationships of marks and SCA, and perceived motivational orientations and self-concept of attainment are analysed as a function of gender.

Relations of cognitive skills and SCA. Table 3 shows that in the 2nd grade the highest correlation emerged between maths skills and maths SCA, indicating that the higher the score a student has in maths tests the higher s/he will rank himself in class. In spite of a minor increase from the 2nd to the 3rd grade, the correlation coefficients between spelling skill and writing self-concept of attainment were relative low in both grades. The strongest increase from 2nd to 3rd grade in association of actual skill to self-perception was manifested in the domain of reading, from .27 to .51. In addition, gender differences existed in the strength of associations, correlations being higher in maths and in reading domains for boys than for girls, whereas an-

Table 3
The concurrent correlations (r) between cognitive skills and corresponding domains of self-concept of attainment

	Second grade ^a			Third grade		
	All (n=100)	Boys (n=49)	Girls (n=51)	All (n=101)	Boys (n=50)	Girls (n=51)
Mathematics skills						
Math SCA	-.35***	-.42**	-.19	-.35***	-.40**	-.19
Word reading skills						
Reading SCA	.27**	.49***	.12	.51***	.56***	.46***
Spelling skills						
Writing SCA	.11	.02	.22	.17	.14	.18

Note: The coefficient of the correlation between math SCA and math skills is negative because of differences in scoring (see method section).

a: One outlier was removed from 2nd grade analyses.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4
Concurrent correlations (n = 90) between school marks and SCA at the 3rd and 6th grades

The domain of the self-concept	School marks	
	Third grade	Sixth grade
Math SCA		Mathematics
All	-.32**	-.62***
Boys	-.28	-.38**
Girls	-.23	-.76***
Reading SCA		Finnish
All	-.24*	-.41***
Boys	-.20	-.42**
Girls	-.29	-.35*
Writing SCA		Finnish
All	-.22*	-.26*
Boys	-.35*	-.14
Girls	-.09	-.29

Note: The negative correlation coefficients are due to the scoring system of the variables.

Boys n = 45, and girls n=45.

*p<.05, **p<.01, ***p<.001

Table 5
Correlations between motivational orientations and school marks at the 6th grade (n = 66^a)

Motivational orientations	Mathematics	Finnish
Task orientation		
All	.63***	.58***
Boys	.60***	.72***
Girls	.70***	.46**
Ego-defensive orientation		
All	-.58***	-.59***
Boys	-.60***	-.68***
Girls	-.61***	-.51**
Social dependence orientation		
All	-.27*	-.54***
Boys	-.41*	-.65***
Girls	-.31	-.34

Note: ^aOnly a subsample was available, since there was missing data in motivational ratings at the 6th grade.

Boys n = 34 and girls n = 32.

*p < .05, **p < .01, ***p < .001

opposite, but weaker, pattern was observed in the writing domain. Gender differences were larger in the 2nd grade than in the 3rd grade. The only significant difference between boys' and girls' correlational patterns were shown in reading SCA in the 2nd grade, $r = .49$ for boys and $r = .12$ for girls ($z = 1.64, p < .05$, two-sided). Regarding all students, the findings above are in line with previous research suggesting that the correlation between self-perception and achievement increases with age and experience (Helmke, 1997; Kurz-Coster & Scheider, 1994). The differential correlational patterns for boys and girls, especially in maths domain, suggests a stronger salience of maths skills for boys' academic self-concept of attainments as opposed to girls' SCA.

Relations of school marks and SCA.

Correlational patterns between school marks and students' self-concept of attainment showed that the strongest association emerged in the maths domain at both grade levels. As expected, the strength of relation increased from the 3rd to the 6th grade in all domains. The drastic change in correlational coefficients over school years suggests that students' self-concept of attainment, especially in mathematics, is weakly related to marks given at the end of the 3rd grade, but after three years of official marks given to the students the association of self- vs. teacher evaluation becomes much stronger. There were no clear gender differences in the strength of relations in the 3rd grade, although boys' writing self-concept correlated significantly with marks as opposed to girls. However, at the end of the primary school, significant differences between boys' and girls' correlational patterns emerged in mathematics, ($z = 2.32, p < .05$, two-sided). The correlational findings indicated that students' maths SCA is more strongly related to school achievement evaluated by the teacher than reading and writing SCA. The significantly higher correlation for girls than for boys between marks in mathematics and maths SCA suggests that school achievement as indicated by marks is one of the key, external frames of reference which influence girls'

academic self-concept, whereas boys' maths self-concept is less affected by official marks.

Motivational orientation of students and school marks. Before computing the separate analysis between each motivational orientation and self-concept of attainment, we analysed the relationship between teacher-rated motivational factors and official marks reported by the teacher at the end of the primary school (see Table 5).

Very significant correlations were found between motivational orientations and school marks, as can be expected on the basis of prior research on motivational orientations (Lehtinen et al., 1995). Teacher-perceived task orientation of all students showed the highest correlation to maths achievement, whereas both task and non-task orientations correlated strongly with Finnish. Gender differences were also found. Task orientation was related to mathematics (marks) more strongly and social dependence was weaker in girls than in boys, while the opposite pattern was observed in Finnish: the strength of relations between orientations and Finnish (marks) were stronger for boys than for girls. The most striking gender difference in correlations emerged in the relation of social dependence to Finnish, ($r = -.65$ vs. $r = -.34, z = 1.61, p < .05$, one-sided). The above findings underscore the role of motivational orientations in the success and failure in students' school careers. From the motivational perspective these findings suggest that the more task approaching behavior a student shows and the lower tendency to avoidance, inhibition of action or immediate help- or cue-seeking behavior they show, the higher grades they will attain. Since teachers were the sources of both motivational and achievement assessments another explanation is also possible: teachers may be likely to attribute successful school performance to high motivation and low school achievement to low motivation in spite of the actual coping strategies the students show during task performance. However, the differential association of social dependence on marks as a function of gender

may suggest that girls' approval seeking and/or compliance behaviors are related more weakly to academic achievement, whereas boys' dependence on the teacher is more strongly related to school achievements. In addition, concentration on and persistence in verbal tasks seems to explain more of the boys' variance in grades in Finnish ($r^2 = .52$) than girls' ($r^2 = .21$).

Relations of teacher's report of student's motivation and student's SCA. Correlations between student's maths, reading and writing self-concept of attainment and teacher perception of the intensity of student's task, ego-defensive and social dependence orientations were computed. The negative coefficients between task orientation and the domains of SCA, revealed that the stronger the task-oriented efforts displayed by the student (i.e., concentration, persistence) the higher self-concept s/he will have, whereas the stronger the tendency for ego-defensive behavior (i.e., avoidance, inhibition), the worse self-perception will be observed. The correlations between social dependence and SCA were weak in the 3rd grade, but was significantly related in the 6th grade in the domain of reading. As expected, the strength of relations increased in all academic domains from the 3rd to the 6th grade, the highest correlation being between maths self-concept and task orientation ($r = -.53$). These correlational results indicate that an increasing correspondence emerges between student's own perceptions and teachers' judgements of student's motivation during the primary grades. In addition, the strength of these associations seems to vary as a function of school subject, gender and motivational orientation. As Table 5 shows, boys' task orientation (TO) correlated significantly with their maths and reading self-concepts, while these relations in girls were weaker. Two suggestive correlation differences were observed: one between TO and maths SCA being higher for boys than for girls in the 3rd grade ($z = 1.62, p = .053$), and another between ego-defensive orientation and reading SCA in the 6th grade being also higher for boys ($z = 1.51, p = 0.66$).

Furthermore, gender differences between

motivation and self-concept were qualified by the domain of self-assessment. For girls, all motivational factors correlated significantly with maths self-concept of attainment in the 6th grade, whereas for boys all motivational factors were significantly associated with their reading self-concept. What do these patterns imply? Given that the teachers' motivational ratings are valid measures of students' actual coping with different learning tasks (Salonen, Lepola, & Niemi, 1998), the findings above suggest that girls' maths self-concept is more strongly related to non-task-oriented factors than are boys' maths SCA. On the other hand, boys' reading self-concept is associated with their non-task-oriented tendencies perceived by the teacher. There is also another potential interpretation for the above relations. These increasing correlations may reflect not only an integration and use of information students receive about their own school performance over the years, but may also be associated with the quality of social interaction between the teacher and the student and the feedback from these teaching-learning interactions. In fact, it has been found that teacher perceptions of student motivation have reciprocal effects with students' self-report of perceived control and academic achievement (Skinner, Wellborn, & Connell, 1990) as well as with teachers' own behavior (Skinner & Belmont, 1993).

Maths SCA as a function of low vs. high task orientation and maths grades. As shown above, task orientation and school achievement in mathematics were both strongly related to students' maths self-concept of attainment in the 6th grade. But in order to investigate the interaction of motivation and school achievement and the effect of this on boys' and girls' maths self-concept of attainment we carried out a further analysis. We examined the effect of motivation through a new variable, High-task vs. Low-task orientation. The criteria for High TO was that the student's mean score was greater than 3 on four (1 to 5) subscales of task orientation, and less than 3 on non-task orientation subscales. In addition, students were divided into the Low or High maths achieving

groups on the basis of marks (from 4 to 10 in Finland) given in the 6th grade. The criteria for Low-achieving group was that the students' grade in maths was 7 or below. The grouping was not directly based on the distribution but merely on the absolute value of the mark.

Analysis of variance were computed separately for the effects of motivation and achievement to maths SCA due to the empty cells in a full model analysis. A 2 (low vs. high task orientation) x 2 (gender) ANOVA was computed for 6th grade maths SCA. A significant interaction was found, $F(1, 84) = 6.81, p < .01$, suggesting that the effect of task orientation on maths SCA is qualified by gender as correlations above indicated. But how? Post hoc (Tukey HSD) analysis showed that girls with low task

orientation rated themselves significantly lower ($p < .05$) than boys with equally low motivation, whilst between the high motivation groups no gender differences were observed (see Figure 2). In addition, a significant interaction of the level of Maths marks x Gender was found, $F(1, 86) = 5.36, p < .05$, revealing that the effect of marks on maths self-concept was more detrimental in low achieving girls than in low achieving boys (see Figure 2). Finally, it was found that girls and boys with the pattern of low task orientation and low maths achievement showed distinctive self-perception in mathematics, $F(1, 15) = 4.82, p < .05$. These distinctive patterns of boys' and girls' self-perception in mathematics suggest that low performing boys' upward ratings reflect a kind of wishful thinking, whereas low achieving girls

Table 6
Concurrent correlations (r) between teachers' report of students' motivational orientation and students' maths, reading and writing SCA

	Third grade ($N=100$; boys, $n = 50$; girls, $n = 50$)			Sixth grade ($N = 75$; boys, $n = 40$; girls, $n = 35$)		
	TO	EDO	SDO	TO	EDO	SDO
Maths SCA						
All	-.30 ^{**}	.17 ^b	.07	-.53***	.38***	.22 ^b
Boys	-.46***	.21	.10	-.48**	.28	.18
Girls	-.16	.13	.07	-.63***	.51**	.45**
Reading SCA						
All	-.23*	.18	.10	-.39***	.29*	.30**
Boys	-.36*	.31	.30*	-.48**	.42**	.36*
Girls	-.09	.05	-.08	-.25	.08	.02
Writing SCA						
All	-.18	.14	-.01	-.21	.03	.19
Boys	-.23	.22	.05	-.20	.01	.14
Girls	-.13	.06	-.07	-.25	.03	.10

Note: ^a = The stronger the task orientation the higher in class distribution. ^b = The stronger the non-task orientation(s) the lower SCA. TO = task orientation, EDO = ego-defensive orientation, SDO = social dependence orientation.

show a more realistic and thus lower self-concept in mathematics at the end of the 6th grade. The above gender differences in SCA was only found in the domain of mathematics.

Discussion

The present longitudinal study was designed to investigate gender differences in the development of maths, reading and writing self-concept of attainment from the 2nd to the 6th grade. We examined how boys' and girls' academic self-estimations correlate with their

current cognitive skills in word reading, spelling and mathematics, as well as with school marks from the 3rd to the 6th grade. In addition, teacher perception of the quality of student's learning motivation, that is, task, ego-defensive and social dependence orientation, was compared with student's own self-perceptions of attainment.

In line with previous research (Eccles et al., 1993; Helmke, 1997), our findings indicated that students' self-concept of attainment decreased significantly from grade 2 to grade 6, which suggests that sixth graders' academic self-concept in maths, reading and writing domains reflect more of their actual achievement

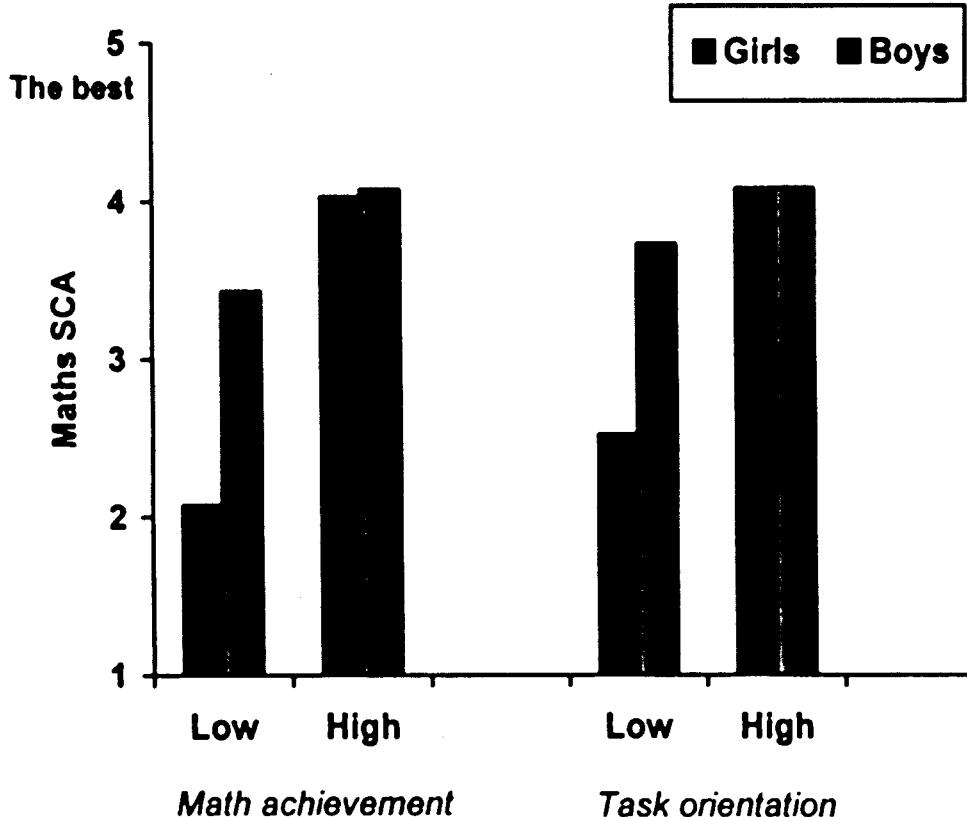


Figure 2: Girls' and boys' maths self-concept of attainment at the 6th grade as a function of task orientation and school achievement in maths

dispersion in the class, and thus are more realistic. The smaller variance of younger children's SCA scores reflects an age-related optimism. Children's self-perceptions were the lowest in the domain of writing and the highest in reading across primary years. Significant gender differences were found, as expected, in the domains of mathematics and writing SCA. In fact, boys showed significantly higher maths SCA than girls in the 3rd and 6th grades, whereas girls' writing SCA was significantly higher than boys' at the end of the 6th grade. Although boys outperformed girls in the 3rd grade in mathematics involving computational and verbal problem solving skills, the gender-based difference in maths SCA was larger than could be explained by actual test differences. This inequality of perceived competence between boys and girls may also facilitate a discrepancy of effort toward mathematics and persistence in tasks involving mathematics and thus reinforce a progressive or regressive career in mathematics. The opposite motivational-cognitive cycle (i.e., when a student perceives him/herself as poor in writing s/he may avoid writing tasks, which further hampers the development of his or her writing skills) in favour of girls may be manifested in the writing domain where boys' SCA decreased drastically from the 3rd to 6th grade. The above findings are in accordance with the study of Skaalvik and Rankin (1994). They not only found gender differences in maths and verbal self-concept and self-perceived skills, but also in motivation: sixth- and ninth-grade boys reported higher maths and lower verbal motivation than girls.

Moreover, we analysed the changes in the strength of correlations between SCA and concurrent cognitive skills. Correlational analyses showed that the strength of association between word reading, spelling and maths skills and correspondent self-concept increased from the 2nd to the 3rd grade especially in the domain of reading. This change of reading correlation coefficient from .27 to .51 can be attributed to the girls' self-estimation pattern as readers in the 3rd

grade. In fact we found in our earlier study that a larger proportion of girls than boys hold an unrealistically high reading SCA in the 2nd grade, whereas they showed more modest self-assessment in the 3rd grade (Lepola & Vauras, 1998).

We also analysed the relationship between marks and self-concept. As hypothesised, the strength of association increased drastically from the 3rd to the 6th grade, especially in mathematics. There were no gender differences in the relation of marks to self-concept in the 3rd grade, but by the end of the 6th grade the correlation between maths marks and maths SCA was significantly stronger for girls than for boys. The results from the 3rd grade should be interpreted as the impact of self-concept on grades, since at the time students rated themselves relative to classmates in the 3rd grade (spring term) they had not yet received numerical evaluation. However, by the time the students' SCA ratings were selected in the 6th grade, they had a fairly good idea of what their final academic grades would be. The highest correlation in mathematics indicates that the teacher's (normative) evaluation gives a student a highly salient subjective standard especially for maths self-assessment. Further analysis of maths mark and maths SCA association revealed that gender difference was qualified by the level of achievement: low-achieving girls showed lower maths self-concept than low-achieving boys, whereas no gender difference in maths SCA was observed among high-achieving children. Accordingly, it seems that *low-achieving boys' self-concept of attainment in mathematics is less affected by external feedback*, that is, their teacher's numerical evaluation, whilst *low-performing girls' self-concept is more dependent on external factors*, that is, *their teacher's grading*. Since our findings were based on correlational analyses with a rather small sample size, we cannot interpret the findings in terms of causality. Further studies are needed to uncover the possible direct and indirect relationship between motivation, self-concept and cognitive performance. Con-

cerning the direction of causal predominance between marks and self-concept, Hoge, Smit, and Crist (1995) found that grades had a bit more influence on self-concept than the other way round (cf. also Helmke & van Aken, 1995).

To unravel the gender differences in relations of motivational orientations and school achievement, we computed correlations between orientations and school marks. High correlation emerged between maths achievement and task orientation ($r = .63$) as well as with ego-defensive orientation ($r = -.58$). Also in the verbal domain, Finnish, the correlations were highly significant. These findings indicated the beneficial role of task orientation and the detrimental roles of ego-defensiveness and social dependence on school achievement. Gender differences were also substantial. In fact, we found differential relationships of motivational orientations with school achievement as a function of the domain and gender: boys' task and non-task orientations were more strongly related to achievement in Finnish than girls', whereas the association of task orientation and mathematics was stronger for girls than for boys. In addition, significant gender difference in the strength of social dependence in Finnish may suggest that official marks given by the teacher are not only determined by actual achievement but are also related to boys' and girls' motivational tendencies in the classroom. Although it has been found that the accuracy of teacher-based assessments of students' achievement levels suggest a moderate correlation (for a review, see Hoge & Coladarci, 1989), there exists also variation in teacher judgements. In fact, Schrader and Helmke (1990) found that students' intelligence and self-concept of ability are significant predictors of teacher's judgements of students' maths achievement beyond students' actual maths test achievement. Further studies are needed to examine the sources of variation in teachers' judgements such as gender and motivational tendencies. This is also of current interest in Finland, since the comparability of students' grades between schools is a problem

encountered repeatedly by school authorities.

The final question concerned the relationship of motivational orientations and *self-concept of attainments*. An increasing correspondence was found between students' SCA ratings and motivational orientation assessed by the teacher from the 3rd to 6th grade. Task orientation was positively related and ego-defensiveness and social dependence were negatively related to the self-concept of attainments. It was noticed that the correlational pattern was not identical between boys and girls. By the end of the 6th grade, a change was observed in the relation of orientations to self-concept: in girls, motivational orientations were strongly related to maths SCA, whereas in boys motivational factors were significantly related to reading self-concept. The effect of the level of task orientation to maths self-concept in boys and in girls was also analysed. We found that correlations were slightly spurious because no difference in maths SCA was observed between girls and boys with high task motivation. However, boys with low-task motivation and low maths achievement rated themselves significantly higher in the class distribution than girls with an equal motivational-achievement pattern. This finding suggests that low performing boys display more a kind of wishful thinking in their maths self-perceptions, whereas low achieving girls show a more realistic and thus lower self-concept in mathematics. It is concluded that maths self-concept operates in different ways for boys and girls of different levels of task motivation or/and achievement.

As a summary, the analyses concerning math self-concept indicated that boys' estimations were more commensurate with their actual cognitive skills in mathematics in the 2nd and 3rd grades than those of girls. However, the relation between math SCA and school marks differed markedly with the boys and the girls in the 6th grade. Girls' math self-concept and their marks in mathematics were more congruent than those of boys. This suggests that boys' math self-perception is more related to their internal

standards and cognitive performance, than that of girls' in the early school years, whereas in the 6th grade external evaluation (i.e., grading) and motivational factors seem to affect the low-performing girls' math self-concept more than that of boys'.

Studies examining the relation of motivational orientations to academic self-concept of ability through path analyses have shown that task involvement is strongly and positively associated with general self-concept, whereas defensive ego-involvement (i.e., a student's concern about the impression they make in class) is only indirectly related with self-concept through self-esteem (Skaavik, Valans, & Sletta, 1994). In contrast to our results, Nicholls (1989) found positive correlation between ego-involvement and perceived ability (cf. also Martin & Debus, 1998). This apparent contradiction to our results is explained by the difference in indicators of ego-involvement and ego-defensive orientation (EDO). The former is related to the goal of trying to compete with others, whereas the focus of the latter (EDO) construct is avoidance of ego-related threats and the purpose is to reduce emotional tension.

Our results have implications for educators and researchers. Our earlier research on the development of motivation and beginning reading skills pointed to the fact that motivational orientations such as ego-defensiveness and social dependency may, as early as at the end of the first school year, produce dysfunctional coping strategies which are detrimental to the formation of reading skills (Salonen, Lepola, & Niemi, 1998). However, it seems that these unfavourable motivational tendencies are not generalised during the early grades of the low academic self-concept, but later on, academic self-perceptions play a part in the success or failure of student careers in school. Accordingly, the earlier we can diagnose those detrimental non-task orientation tendencies toward learning, the better we can prevent the formation of unfavourable self-concept of learning. In

addition, the self-concept of attainment is a meaningful diagnostic method for both classroom and special teachers to assess their students' academic self-perceptions during primary years in order to be aware of the development of boys' and girls' beliefs of themselves as a learner, and to bring students' self-perceptions in line with or even slightly above of their actual competence.

References

Bouffard, T., Markovits, H., Vezeau, C., Boisvert, M., & Dumas, C. (1998). The relation between accuracy of self-perception and cognitive development. *British Journal of Educational Psychology*, 68, 321-330.

Blatchford, P. (1997). Pupils' self assessments of academic attainment at 7, 11 and 16 years: Effect of sex and ethnic group. *British Journal of Educational Psychology*, 67, 169-184.

Brophy, J. E. (1983). Research on the self-fulfilling prophecy and teacher expectations. *Journal of Educational Psychology*, 75, 631-661.

Chapman, J. W., & Tunmer, W. (1997). A longitudinal study of beginning reading achievement and reading self-concept. *British Journal of Educational Psychology*, 67, 279-291.

Crandall, V. J., Katkovsky, W., & Preston, A. (1962). Motivational and ability determinants of young children's intellectual achievement behaviors. *Child Development*, 33, 643-661.

Eccles, J., & Wigfield, A. (1985). Teacher expectations and student motivation. In J. B. Dusek, V. C. Hall, & W. J. Meyer (Eds.), *Teacher expectancies* (pp. 185-226). Hillsdale, NJ: Erlbaum.

Eccles, J., Wigfield, A., Harold, R. D., & Blumenfeld, P. (1993). Age and gender differences in children's self- and task perceptions during elementary school. *Child Development*, 64, 830-847.

Festinger, L. (1954). A theory of social

comparison processes. *Human Relations*, 7, 117-140.

Harter, S. (1992). The relationship between perceived competence, affect, and motivational orientation within the classroom: Processes and patterns of change. In A. K. Boggiano & T. S. Pittman (Eds.), *Achievement and motivation: A social-developmental perspective* (pp. 77-114). New York: Cambridge University Press.

Helmke, A. (1997). Entwicklung lern- und leistungsbezogener Motive und Einstellungen: Ergebnisse aus dem SCHOLASTIC-Projekt. In F. E. Weinert & A. Helmke (Eds.), *Entwicklung im Grundschulalter* (pp. 59-76). Weinheim, Deutschland: Beltz.

Helmke, A., & van Aken, M. A. G. (1995). The causal ordering of academic achievement and self-concept of ability during elementary school: A longitudinal study. *Journal of Educational Psychology*, 87, 624-637.

Hoge, D. R., & Coladarci, T. (1989). Teacher-based judgements of academic achievement: A review of literature. *Review of Educational Research*, 59, 297-313.

Hoge, D. R., Smit, E. K., & Crist, J. T. (1995). Reciprocal effects of self-concept and academic achievement in sixth and seventh grade. *Journal of Youth and Adolescence*, 24, 295-314.

Kurtz-Coster, B. E., & Schneider, W. (1994). Self-concept, attributional beliefs, and school achievement: A longitudinal analysis. *Contemporary Educational Psychology*, 19, 199-216.

Lehtinen, E., Vauras, M., Salonen, P., Olkinuora, E., & Kinnunen, R. (1995). Long-term development of learning activity: Motivational cognitive, and social interaction. *Educational Psychologist*, 30, 21-35.

Lepola, J., & Vauras, M. (1998, March). *Development of children's math and reading self-perceptions of attainment from the 2nd to the 5th grade: Relations to gender, academic achievements and perceived motivational orientation*. Poster presented at the 6th Workshop on Achievement Motivation and Task Motivation, Thessaloniki, Greece.

Mäki, H., Voeten, M., & Vauras, M. (1998). *Predicting writing skill development with decoding and preschool readiness skills*. Manuscript submitted for publication.

Marsh, H. W., Caven, R., & Debus, R. (1998). Structure, stability, and development of young children's self-concept: A multicohort-multioccasion study. *Child Development*, 69, 1030-1053.

Martin, A. J., & Debus, R. L. (1998). Self-reports of mathematics self-concept and educational outcomes: The roles of ego-dimensions and self-consciousness. *British Journal of Educational Psychology*, 68, 517-535.

Muijs, R. D. (1997). Predictors of academic achievement and academic self-concept: A longitudinal perspective. *British Journal of Educational Psychology*, 67, 263-277.

Nicholls, J. G. (1978). The development of concepts of effort and ability, perception of academic attainment and the understanding that difficult tasks require more ability. *Child Development*, 49, 800-814.

Nicholls, J. G. (1989). *The competitive ethos and democratic education*. Cambridge, MA: Harvard University Press.

Nolen, S. (1988). Reasons for studying: Motivational orientations and study strategies. *Cognition and Instruction*, 5, 269-287.

Olkinuora, E., & Salonen, P. (1992). Adaptation, motivational orientation and cognition in a subnormally performing child: A systemic perspective for training. In B. Wong (Ed.), *Contemporary intervention research in learning disabilities: An international perspective* (pp. 190-213). New York: Springer.

Rosenholtz, S. J., & Simpson, C. (1984). The formation of ability conceptions: Developmental trend or social construction. *Review of Educational Research*, 54, 31-63.

Rosenthal, R. (1985). From unconscious experimenter bias to teacher expectancy effects. In J. B. Dusek, V. C. Hall, & W. J. Meyer (Eds.), *Teacher expectancies* (pp. 37-66). Hillsdale, NJ: Erlbaum.

Ruble, D. N., Grovesky, E. H., Frey, K. S., & Cohen, R. (1992). Developmental changes in competence assessment. In A. K. Boggiano & T. S. Pittman (Eds.), *Achievement and motivation: A social-developmental perspective* (pp. 138-166). New York: Cambridge University Press.

Salonen, P., Lehtinen, E., & Olkinuora, E. (1998). Expectations and beyond: The development of motivation and learning in a classroom context. In J. E. Brophy (Ed.), *Advances in research on teaching* (Vol 7, pp. 111-150). London: JAI.

Salonen, P., Lepola, J. S., & Niemi, P. (1998) The development of first graders' reading skill as a function of pre-school motivational orientation and phonemic awareness. *European Journal of Psychology of Education*, 13, 155-174.

Schrader, F-W., & Helmke, A. (1990). Are teachers' grades influenced by non-achievement-related considerations? An analysis of the determinants of teachers' diagnostic competence. *Zeitschrift fuer Entwicklungspsychologie und Paedagogische Psychologie*, 22, 312-324.

Skaalvik, E. M., & Rankin, R. J. (1994). Gender differences in mathematics and verbal achievement, self-perceptions and motivation. *British Journal of Educational Psychology*, 64, 419-428.

Skaalvik, E. M., Valens, H., & Sletta, O. (1994). Task involvement and ego-involvement: Relations with academic achievement, academic self-concept and self-esteem. *Scandinavian Journal of Educational Research*, 38, 231- 243.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology*, 85, 571-581.

Skinner, E. A., Wellborn, J. G., & Connell, J. P. (1990). What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology*, 82, 22-32.

Stipek, D. J., & Gralinski, J. H. (1991). Gender differences in children's achievement-related beliefs and emotional responses to success and failure in mathematics. *Journal of Educational Psychology*, 83, 361-371.

Vauras, M., Hannula, M., Kinnunen, R., Kajamies, A., & DeCorte, E. (1998). *Quality of mathematical problem solving in high- and low-achieving primary school students*. Manuscript in preparation.

Waterhouse, S. (1991). Person formulation in the process of schooling. *British Journal of Sociology of Education*, 12, 45-59.