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Value orientations in relation to mathematical self-esteem: An exploratory study of their role in mathematical achievement among German, Israeli, and Canadian 14-year-olds

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The present paper offers an exploration of the role achievement values play in the generation of mathematical achievement as measured in school grades and test scores. Based on a comparative study of 1665 German, Israeli, and Canadian 14-year-olds two hypotheses are tested. First, it is assumed that achievement value preferences have a dual role in the generation of high academic performance. On the one hand, they are assumed to facilitate a high achievement-related self-esteem, which itself is a strong covariate of good academic performance. On the other hand, they are expected to sensitize for achievement pressure from parents, which in turn increases anxiety, and henceforth lowers the achievement-related self-esteem. Secondly, it is assumed that one will find cross-cultural variation in the strength of the two postulated effects. The "positive" role of achievement values is assumed to be stronger in cultures with a more positive view on achievement (Canada, Israel), whereas the "negative" role is assumed to be stronger in cultures with a less positive view on achievement (Germany). Hypotheses were tested in a structural equation modeling frame, and are essentially confirmed. Effect sizes are, however, low, and confirmation pertains almost exclusively to grades, not to test scores as measures of mathematical abilities.

Recent international comparisons of students' academic achievement have shown enormous worldwide differences in abilities to comprehend text and to solve mathematical problems. In the Program for International Student Assessment (PISA) Canada ranked in the top achievement group (Adams & Wu, 2002). Germany's students emerged below the OECD average (Baumert et al., 2001), creating a public uproar in Germany, in particular because this

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replicated findings of the Third International Mathematics and Science Study (TIMSS, Martin et al., 2000), There Germany, Canada, and Israel had middle range ranks.

Germany's largest funder of scientific research, the DFG, launched a well-endowed research scheme on the "Educational Quality of Schools" as a consequence of these findings. The current study was undertaken in this framework; the present report focuses on the relationship of achievement values and academic performance. While a positive effect of high achievement value preferences on academic performance can be expected *prima face* (Bellah, Madsen, Sullivan, Swidler, & Tipton, 1985), it is proposed here that high achievement value preferences can also endanger performance by increasing students' anxiety levels: High achievement value preferences are assumed to increase perceived achievement pressure from parents, which in turn increases anxieties and lowers students' self-esteem, which itself is central to good academic performance. Hansford and Hattie's (1982) meta-analysis showed an average correlation between esteem and performance of around .25.

What role do achievement values play in the generation of academic performance? This depends very much on the definition of "achievement values". Two review articles have recently appeared that allow to address the question in detail, one in the *Annual Review of Sociology* (Hitlin & Piliavin, 2004), one in the *Annual Review of Psychology* (Eccles & Wigfield, 2002). At first glance, the articles seem to come from different planets: Only two references cited in each article overlap (Feather, 1992; Rokeach, 1979). However, a closer look reveals that different application foci make the reviews so different. Hitlin and Piliavin concentrate on the definition of values, their origin, and their consequences. They analyze current value theories, most prominently Schwartz (1992), review processes of value socialization and transmission, and briefly characterize values not simply as abstract conceptions of the desirable, but as the motivational basis of social behavior, expressing basic human needs (Rokeach, 1973; Schwartz, 1992). The link between values and behavior is discussed only peripherally.

Eccles and Wigfield (2002) elaborate on similarities and differences of concepts like motivation, beliefs, goals, and values. Their emphasis is on the role of values in the genesis of behavior in the educational sphere. Does this mean that value conceptions as reviewed by Hitlin and Piliavin (2004), for example Schwartz's (1992) theory, differ distinctly from the value conception of Eccles and Wigfield? Schwartz's approach is not discussed in Eccles and Wigfield's review, nor is Eccles's position in Hitlin and Piliavin's review. The reader must, however, be reminded that Schwartz's value theory had the same meta-theoretical starting point as that of Eccles, expectancy-value models. Schwartz's early work on prosocial behavior (Schwartz & Howard, 1982) was the starting point of his value theory. Both Eccles and Schwartz refer to Rokeach and to Feather, the two overlapping sources of the cited review articles. Eccles and Wigfield (2002) indicate that Feather (e.g., 1988, 1992) extended Atkinson's (1964) expectancy-value model by broadening the conceptualization of values. They see their own conceptualization of the role of values comparable to that of Feather (1988), labeling both approaches "modern expectancy-value models". Feather's understanding of values is explicitly cited by Schwartz (1992) as offering a similar conceptual understanding of values, particularly as both are rooted in the work of Rokeach. It thus seems plausible to see values as conceptualized by Eccles and by Schwartz as sufficiently congruent to see them as a joint starting point in assessing the impact of values on school achievement.

Returning to the question of the relation of achievement values and academic performance, work by Wigfield (1994; Wigfield & Eccles, 1994) can be highlighted. Eccles and Wigfield (2002) characterize achievement values as a "focusing device": students who have high achievement values are more focused on achievement, more concentrated and more motivated to work for school, become more self-efficacious and confident in their work, and eventually perform better. The positive relationship between achievement values and academic performance is likely to be mediated by other variables, among them general and domain-specific self-esteem, not a direct one which assumes students with high achievement values to be good students *per se*.

A possible negative consequence of high achievement values, on the other hand, has gained little attention. Besides being a positive "focusing device", achievement values may

also be a negative "focusing device" for middle school students. Ablard, Hoffhines, and Mills (1996) report that 39% of gifted children report feeling pressure from their parents to be exceptional students. These 39% are a minority of all students whose parents express high achievement expectations, but most likely students with the highest achievement values also experience most achievement pressure from their parents. This assumption is supported by Hill et al.'s (2004) work on perfectionism. In a perfectionism inventory they introduce a subscale on "perceived parental pressure" ("My parents hold me to high standards") and a subscale on "striving for excellence" ("I drive myself rigorously to achieve high standards"). These two subscales are correlated (r=.31). Hill et al., also cross-validate their perfectionism inventory by relating it to pre-existing instruments. They show that their perceived parental pressure subscale is correlated (r=.39) to the personal standards subscale from Hewitt and Flett's (1991) perfectionism scale. A reason for this correlation presumably is that student with high achievement values are prone to see significant others as also advocating achievement strongly. They will in all likelihood see their parents as putting high emphasis on achievement. High parental achievement expectations, however, have been shown to be a source of anxiety among children (e.g., Cornell, 1989) detrimental to self-esteem and academic performance (Hembree, 1990; Boehnke, 1996; Alva & de los Reyes, 1999).

The first hypothesis of the present study, thus, is that achievement values (Schwartz, 1992) have an antagonistic influence on academic performance. On the one hand, they are part of the achievement-related self-concept, and as such are assumed to covary positively with academic self-esteem and academic performance. On the other hand, they increase the perception of high parental achievement expectations, which augment children's anxiety level, which then reduces academic self-esteem and academic performance.

Not always does high parental achievement pressure lead to anxieties, however. Research shows that high parental achievement expectations can also have positive effects on students' self-esteem and academic performance (Okagaki & Frensch, 1998). The *positive* impact of achievement values on academic performance could also be mediated through parental achievement expectations. We have to leave the resolution of this question to our empirical study.

We do not conceptualize achievement values as a trait-like personality variable. As Hitlin and Piliavin (2004) point out, traits are fixed aspects of personality. Trait-based and values-based behavior must clearly be distinguished: One may have a disposition toward being aggressive (a trait) but may not highly value aggression (Epstein, 1989). Roccas, Sagiv, Schwartz, and Knafo (2002) suggest that traits are enduring positive or negative dispositions, while values are enduring – primarily positive – goals. Values, but not traits, serve as standards for judging others' (and one's own) behavior.

Values are acquired in the family and the extended context (Roberts & Bengtson, 1999). Value preferences also reflect national cultures. Cultures can be described in terms of modal value preferences (Hofstede, 2001); they differ substantially in average endorsement of achievement values (Nelson & Shavitt, 2002; Boehnke, 2003). Schwartz and Sagiv (1995) demonstrated that "Anglo" countries (the US, Canada, Great Britain, Australia, New Zealand, but also Israel) have above average achievement value preferences, while Central European countries, among them Germany, put less emphasis on achievement values. For adolescents Boehnke (2003) reported similar results. This empirical finding leads to the second hypothesis.

It is assumed that of the two paths of influence of values on academic performance, the "positive" one will be stronger in cultures where achievement values are cherished values (Canada/Israel), while where achievement values are not preferred to the same extent, the "negative" path will prevail (Germany).

To elaborate on this proposition we need to revert to the exact definition of achievement values. Achievement values are defined by Schwartz (1992) as reflecting the guiding principle of "personal success through demonstrating competence *according to social standards*" (Schwartz & Boehnke, 2004, p. 239), and by "striving to demonstrate competence in everyday *interaction*" (Schwartz, 1992, p. 40). If social standards do not see achievement as something highly desirable a dilemma emerges, as an individual cherishing such values will have

difficulties to use them as a "positive focusing device". It is difficult to get rewards for high achievement in such countries, and therefore the "neuroticizing" impact of high achievement values will take the edge over the "empowering" impact. The reverse seems plausible for cultures with high emphasis on achievement values. There, individuals with high achievement values are "better" exemplars of the cultural mainstream and, thus, tend to be rewarded for holding such values. Only when there is a good fit between an adolescent's (high) achievement value preferences and the prototypical preference level of achievement values in his/her culture, achievement values can function as a "positive focusing device". In case of a mismatch, achievement values are more likely to function as a "negative focusing device".

To summarize, two hypotheses will be tested: (1) Two antagonistic mechanisms have to be considered when the influence of achievement values on academic performance is analyzed, a positive one, where achievement values let the individual focus on behavior enabling good academic performance, enhance the domain-specific self-esteem and eventually improve the academic performance it self, and a negative one, where achievement values increase the perception of achievement pressure, creating anxiety, lowering self-esteem and eventually academic performance; (2) The positive mechanism will have stronger impact in cultures where achievement is valued highly, while the negative mechanism will be stronger in cultures with a lower preference for achievement values.

Both hypotheses will be tested for school grades as an indicator of mathematical performance, and for mathematical tasks, a more straightforward objective measure of mathematical abilities within one model.

Methods

Samples

The samples of the present study were stratified convenience cluster samples of eighth and ninth graders in Germany, Canada, and Israel. In Germany 14 randomly selected schools from *Gymnasium* (the university-bound school track) and *Mittelschule* (a school track typically leading to vocational training) were selected. In Canada two schools each were selected purposively from more well-to-do and from poorer districts. In Israel the same rationale was followed, but only one school each was included. Places of study were Chemnitz in (formerly) East Germany, Calgary in Canada, and Haifa and Beer-Sheva in Israel.

Altogether 336 girls and 305 boys were included in Germany, 301 girls and 304 boys in Canada, 205 girls and 214 boys in Israel.

Instruments

Information on school grades in mathematics, three mathematical tasks, mathematical self-esteem, manifest anxiety, parental achievement expectations, and achievement value preferences was gathered.

Students were to indicate their most recent report card grade in mathematics. In Israel and Canada grades were given in percent values. German grades were given in the classical form (1=excellent, corresponding to A/A+, to 6=insufficient, corresponding to F/F-). For the purpose of a common analysis classical grades were transformed into percentage grades for the German sample[1].

As an objective assessment of the mathematical abilities, three tasks from the TIMS Study task pool (see Martin et al., 2000) were administered [Example, "In the following we would like to ask you to solve three math tasks. There are four to five possible answers. One of them is correct. Please mark the correct answer. (1) Brighto soap powder is packed in cube-shaped cartons. A carton measures 10 cm on each side. The company decides to increase the length of each edge of the carton by 10 per cent. How much does the volume increase?

A. 10 cm^3, B. 21 cm^3, C. 100 cm^3, D. 331 cm^3]. Number of correctly solved tasks was used as the measure of mathematical ability, thus, values between "0" (no task solved) and "3" (all tasks solved) were possible. Official German and Hebrew translations exist for these tasks.

Mathematical self-esteem was measured by nine items taken from the Second International Mathematics Study (Westbury & Travers, 1990) [Example: "Regardless of how much I strive, I will never be good in math"]. Answering options ranged from "completely true" (0) to "not at all true" (3). High scores stand for high mathematical self-esteem. The scale had a consistency of α=.93 in the overall sample, country-specific α's ranged from .90 to .94. An official Hebrew translation exists for this scale. The German translation was provided by Gruehn (1993).

Manifest anxiety was measured by six items from the Revised Children's Manifest Anxiety Scale (RCMAS, Reynolds & Richmond, 1978) [Example: "Often I have trouble getting my breath"]. Unlike in the original RCMAS, which used a yes-no answering format, here also a four-point rating scale was used. The scale had a consistency of α=.62 in the overall sample (country-specific α's from .57, Germany, to .71, Canada). The German version was introduced by Boehnke, Silbereisen, Reynolds, and Richmond (1986), while the Hebrew version originated from work by Gavron, Katz, and Galatzer (1995).

Parental achievement expectations were measured using three items from Wild, Remy, Gerber, and Exeler (2001) [Example: "My parents want to see high achievement, no matter how hard I have to work for it"]. Items had to be answered on a four-point rating scale ranging from "0" (not at all true) to "3" (completely true). The three-item scale had a consistency of α=.76 in the overall sample (country-specific α's from .73 to .75). The scale was translated to English by the present author, and backtranslated by another bilingual; the Hebrew version was translated by the Israeli cooperation partner (see Footnote on p. 227).

Achievement value preferences were measured by four achievement items from the portrait version of the Schwartz Value Survey (Schwartz et al., 2001) [Example: "Here we briefly describe some people. Please read each description and think about how much each person is or is not like you. Put a number in the box to the right that shows how much the person in the description is like you; "1"=not like me at all, "2"=not like me, "3"=a little like me, "4"=somewhat like me, "5"=like me, "6"=very much like me: "Being very successful is important to her/him. She/he likes to impress other people"]. The four-item scale had a consistency of α=.77 (country-specific α's from .72 to .78). Authorized English and Hebrew versions of the scale are available from the scale author. The German version was adapted from Bubeck and Bilsky (2004).

Results

Table 1 presents the result of one-way ANOVAs with "country" as independent variable. Dependent variables are math grades, math test scores, and scale scores (across-item means) for mathematical self-esteem, manifest anxiety, parental expectations, and achievement value preferences.

Table 1 shows significant cross-national differences for four variables; no differences were found for manifest anxiety. For most recent grades and for achievement value preferences the between-country differences were substantial (η^2>.10). Single comparisons (Scheffé) were also significant at least on the 5% level for all variables with a significant overall *F*. Grades were highest in Israel, followed by Canada and Germany. This finding does not reflect ability differences, but more so national grading traditions as for the three math tasks the ranking of mean scores was almost reversed.

Mathematical self-esteem reflects grade differences. It is highest in Israel, followed by Canada and Germany.

Parental achievement expectations – as viewed by the students – are highest in Canada with Israel second and Germany third.

Table 1

Means of all variables and One-Way ANOVA results

Dependent variables country	Most recent grade in mathematics	Number of math tasks solved (out of 3)	Mathematical self-esteem	Manifest anxiety	Parental expectations	Preference of achievement values
Germany	65.4	.99	1.76	1.06	1.72	3.25
Canada	75.5	.71	1.98	1.11	2.07	3.80
Israel	79.1	.78	2.13	1.06	1.91	4.07
F and *p* of country effect	F=139.08, p>.001, η^2=.14	F=16.54, p<.001, η^2=.02	F=27.73, p<.001, η^2=.03	F=1.51, p=.215, η^2<.01	F=57.09, p>.001, η^2=.06	F=91.60, p=<.001, η^2=.10

Achievement value preferences were highest among Israeli students. Canadian students were in the middle, while among German students achievement value preferences were quite low.

To test the two hypotheses elaborated in the introduction structural equation analyses – performed with AMOS 4 (Arbuckle, 2001) – are first presented for the overall sample. This strategy is advocated by cross-cultural methodologists for cases where a general model first needs to be established as the transcultural model (van de Vijver & Leung, 1997). All analyses were performed with latent variables (not scale scores) for all variables measured by more than one item (i.e., except grades and test scores). The model tested first was the fully mediated "negative" model, where high preferences of achievement values let the students perceive high achievement expectations of their parents, leading to higher degrees of manifest anxiety, which is detrimental to mathematical self-esteem, where low self-esteem predicts low grades. A second model (2) retains the assumptions of Model 1, but assumes an additional opposite influence of achievement values, high achievement values fostering mathematical self-esteem. Model 3 assumes an additional positive influence of high parental expectations on mathematical self-esteem. Model 4a assumes an additional direct positive influence of high parental expectations on grades. Model 4b assumes an additional direct positive influence of high parental expectations on mathematical test scores. For Model 5 an empirically determined path between the variables "grade" and "mathematical test scores" are allowed[2]. Fit coefficients for the six models are presented in Table 2.

Table 2

Fit measures for grand sample models

Model		*df*	*p*	*GFI*	*PGFI*	*RMSEA* (lower bound/ upper bound)
1	1623.06	249	p<.001	.920	.763	.057 (.054/.060)
2	1549.65	248	p<.001	.924	764	.056 (.053/.058)
3	1537.17	247	p<.001	.925	.762	.056 (.053/.058)
4a	1499.69	246	p<.001	.928	.761	.055 (.052/.058)
4b	1493.83	245	p<.001	.928	.758	.055 (.052/.058)
5	1479.56	244	p<.001	.928	.756	.055 (.052/.057)

Table 2 shows significant fit increases step by step from Model 1 to Model 5. The step by step improvement is, however, not very sizable, and from Model 3 onward the parsimony-corrected fit decreases. This means that no additional knowledge is gained from adding more

complexity to the model. The decision which transcultural model to accept remains somewhat ambiguous: From the point of view of significance, Model 5 can be accepted, from the viewpoint of parsimony Model 2 is the model of choice. As Model 2 concurs fully with the conceptual assumptions, Figure 1 presents path coefficients for Model 2 only, omitting loadings of items on the latent variables[3].

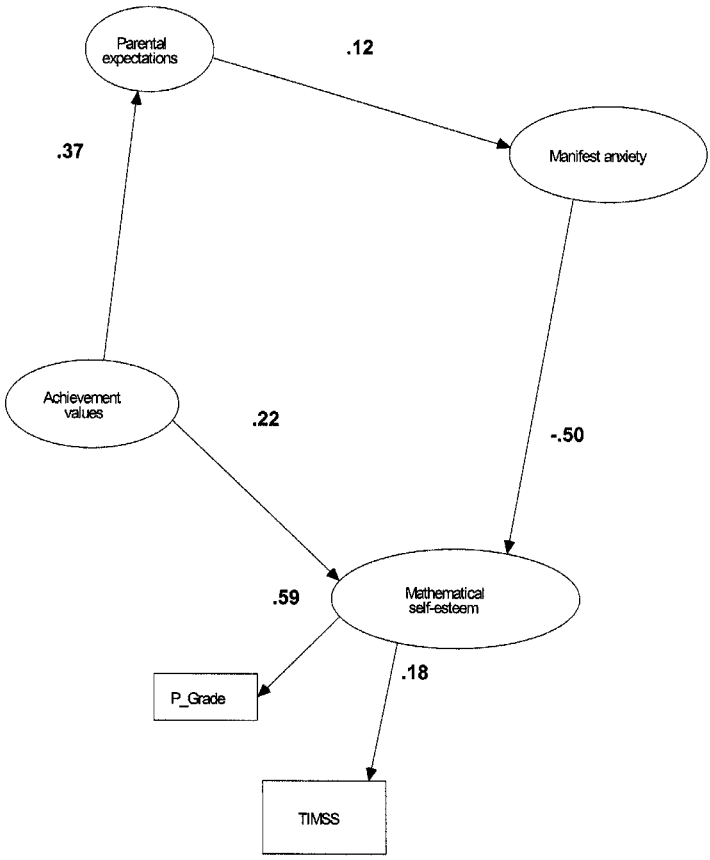

Figure 1. Effects of achievement value preferences on mathematical performance

Figure 1 presents evidence for both negative and positive effects of high achievement value preferences on mathematical school and test performance. Achievement values have a positive mediated effect on grades in math that amounts to β'=.13[4]. They also have a positive mediated effect on test scores, but this effect amounts only to β'=.04. The postulated negative effect mediated through parental achievement expectations, manifest anxiety, and mathematical self-esteem is considerably lower, predominantly because the mediation chain is longer. The negative effect amounts to β'=-.01. The mediated negative effect on grades is as low as β'=-.004.

The essential finding of the transcultural analyses, thus, is that achievement values do function as a focusing device in the generation of actual academic performance. Both a positive and a negative mediated effect can be substantiated. *Prima face*, the positive effect is more sizable than the negative effect. The effect of value preferences on performance in math is considerably larger for school grades than for test scores.

To test the second hypothesis, namely that in cultures with high preferences of achievement values (Israel, Canada), the negative impact of high achievement values on performance should be minimal, while in cultures with a low preference of achievement values (Germany) the negative impact of achievement on performance should be higher, data from the three countries were analyzed in a multi-sample design based on Model 2. Analyses commenced by assuming full equality of path coefficients in all three countries[5]. That model had the following fit coefficients: χ^2=2101.46, *df*=756, *p*<.001, *GFI*=.902, *PGFI*=.758, *RMSEA*=.032 (.031/.034). Subsequently paths were successively freed on the basis of modification indices provided by AMOS. It was then checked whether freeing a certain path would lead to a significant increase in fit. Results showed that freeing two of the six paths of the model led to a fit improvement (parental expectations predicting manifest anxiety – $\Delta\chi^2$=8.22, *df*=2 – and achievement value preferences predicting mathematical self-esteem – $\Delta\chi^2$=6.37, *df*=2), while for all other paths no significant increase was achieved by loosening the equality constraint. The fit coefficients for the final model are χ^2=2086.87, *df*=752, *p*<.001, *GFI*=.904, *PGFI*=.754, *RMSEA*=.032 (.031/.034). Figure 2 reports path coefficients for all countries.

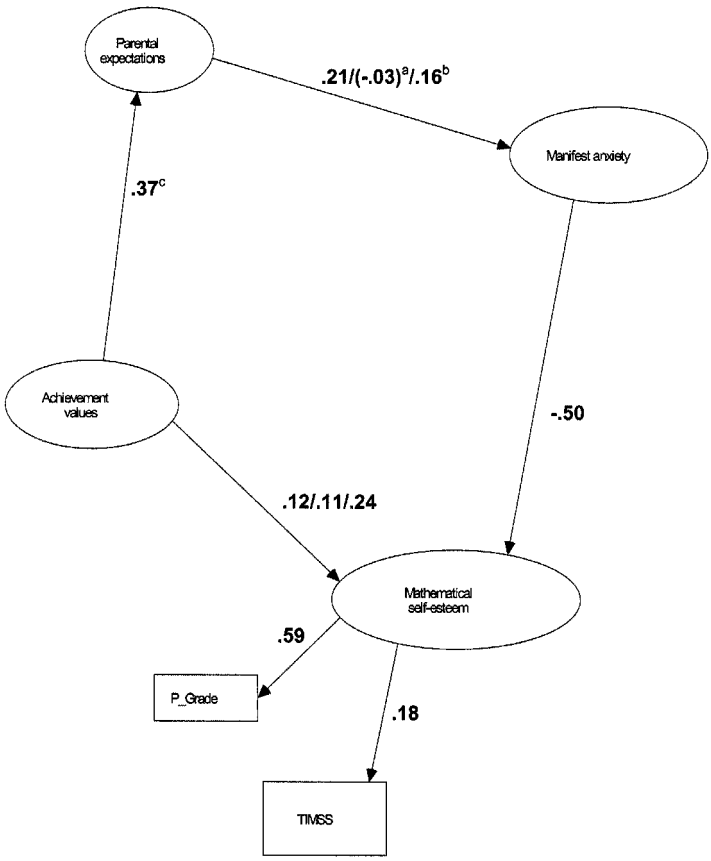

Figure 2. Effects of achievement value preferences on mathematical performance

Note. [a]A coefficient in parentheses indicates insignificance, [b]The first coefficient pertains to the German, the second to the Israeli, and the third to the Canadian sample, [c]The equal coefficients are taken from the transcultural model! Equality constraints lead to equal parameters only for unstandardized parameters, not for standardized parameters. These may differ due to different variances in the different cultures. However, reporting unstandardized parameters adds a technical twist to the presentation that is often difficult to comprehend, while reporting the correct standardized parameters for the different countries would give the impression that parameters differ between countries where statistically they do not.

Figure 2 shows two differences between the three countries, while for most relationships the transcultural model was corroborated. One of the differences pertains to the relationship of parental achievement expectations and manifest anxiety. This postulated relationship was found in Germany and Canada, not in Israel. Secondly, the relationship between achievement value preferences and mathematical self-esteem differed in size between the countries. It was approximately twice as large in Canada (β=.25) than in Germany (β=.12) and Israel (β=.11).

Altogether 30.5% of the variance in grades and 2.8% of the variance in mathematical test scores are explained by the model in Germany, 34.8% and 4.2% in Israel, and 33.2% and 7.7%, respectively, in Canada. Achievement values – directly and indirectly – explain little variance in objective mathematical abilities, but substantial amounts of variance in math grades.

A final look must be taken at sizes of direct and indirect "negative" and "positive" effects of achievement value preferences on mathematical performance. Table 3 documents direct effects of achievement values on mathematical self-esteem with indirect effects as described above and "positive" and "negative" effects of achievement value preferences on the two performance indicators, both for the grand sample and for the three countries separately.

Table 3

Effects of achievement value preferences on mathematical performance

	Germany	Israel	Canada	Grand Sample
Direct effects of achievement value preferences on mathematical self-esteem (Row A)	.122	.106	.242	.221
Indirect effects of achievement value preferences on mathematical self-esteem (Row B)	-.026 (-.296)[a]	-.005 (-.171)[a]	-.022 (-.280)[a]	-.022 (-.280)[a]
Direct effects of mathematical self-esteem on grades in mathematics (Row C)	.552	.590	.576	.588
Direct effects of mathematical self-esteem on mathematical test scores (Row D)	.168	.204	.277	.183
Indirect positive effects of achievement value preferences on grades in mathematics (Row A x Row C)	.067 (.260)[b]	.063 (.250)[b]	.139 (.373)[b]	.130 (.360)[b]
Indirect negative effects of achievement value preferences on grades in mathematics (Row B x Row C)	-.014 (-.346)[c]	-.003 (-.233)[c]	-.013 (-.336)[c]	-.013 (-.337)[c]
Indirect positive effects of achievement value preferences on mathematical test scores (Row A x Row D)	.020 (.143)[b]	.022 (.147)[b]	.067 (.259)[b]	.040 (.201)[b]
Indirect negative effects of achievement value preferences on mathematical test scores (Row B x Row D)	-.004 (-.257)[c]	-.001 (-.179)[c]	-.006 (-.279)[c]	-.004 (-.252)[c]

Note. [a]Cubic root of the absolute value of the preceding coefficient, [b]Square root of the preceding coefficient, [c]Fourth root of the preceding coefficient.

Table 3 not only reports the direct and indirect effects as given by AMOS. It also gives corrected coefficients. When comparing direct with indirect effects, the latter will almost always be smaller than the prior, because by definition direct effects are estimated by the standardized path coefficients, while indirect effects are product terms, which become ever smaller the more "steps" of indirectness exist. A comparison of sizes will, thus, almost always show that direct effects are stronger than indirect effects. Such a comparison, however, seems to be inconclusive. Had one been able measure the impact of the combination of the variables making up for the indirect effect in a single measure, the direct effect of that measure would automatically have been higher. To correct for this "unfairness", Table 3 also reports corrected coefficients, where raw coefficients for an indirect effect are corrected for the number of steps that the indirect effect went through. For example, when the indirect negative effect of achievement values on mathematical self-esteem is to be estimated, the cubic root of the raw indirect effect was calculated, because the chain of influence went through three steps, while for the direct positive effect of achievement values on mathematical self-esteem only one step was necessary.

Looking at the corrected sizes of indirect positive and negative effects of achievement values on grades in mathematics in the three countries, it becomes evident that indeed, as postulated in the introduction, for Germany the negative effect is stronger than the positive (β*=-.346 *vs*. .260), while for the other two countries the positive effect is stronger (β*=-.233 *vs*. .250 for Israel; β*=-.336 *vs*. .373 for Canada). The differences are not very sizable, but all three results concur with the assumptions. As the calculation mode for comparing sizes of direct and indirect effects has been proposed here for the first time, a significance test is not yet available[6].

For mathematical test scores effects are generally smaller with corrected negative coefficients larger than corrected positive coefficients in all countries.

Discussion

Before results are discussed, it should be stressed that the reported study is exploratory in nature. All thoughts are more or less ad hoc amalgamations of existing work, predominantly by Eccles and by Schwartz, so the formulation of hypotheses remains in an early conceptual state.

Findings of the present exploratory study, in essence, confirm that high achievement values have an ambivalent impact on academic performance in mathematics. The impact of achievement values on performance is always indirect: Such values impact the achievement-related self-esteem.

It was shown that there is a two-fold influence of achievement values on grades, they impact the achievement-related self-esteem positively *and* negatively. Considering raw scores, positive effects seem much stronger than negative effects. However, if one weighs the effect sizes by number of steps in the above-described way, it emerges that both effects are of a similar size.

The cross-cultural hypothesis of a differential impact of achievement values could also be confirmed. It is indeed the case that both in Israel and Canada, the positive effect of high achievement value preferences on grades in mathematics is stronger than the negative effect. In Germany, however, the corrected negative effect is stronger than the positive effect. The reasons why the negative impact of achievement values on grades is lower in Israel and Canada than in Germany, do differ, however. In Canada the impact of high achievement value preferences on mathematical self-esteem is substantially larger than in the other two countries, thereby leading to a stronger indirect impact of values on grades. In Israel the impact of values on self-esteem is comparable to Germany. The role of parental achievement expectations, however, differs from the other two countries. While in Germany and Canada, high perceived parental achievement expectations are a hotbed of manifest anxiety, this is not the case in Israel. There the two are uncorrelated. Thus, the chain of a possible negative indirect impact of

values on grades is broken in Israel, and consequentially, the negative impact of values on grades is lower.

For mathematical test scores, effects are, in essence, the same as for grades, but effect sizes are dramatically smaller. Only for Canada can one speak of a noteworthy effect of values on test scores. This finding raises a point of discussion. Substantial influence of values on performance exists predominantly for the social component of performance evaluation. Grades have a major social component. In his seven-country study Boehnke (1996) showed that teachers' perceptions of a student's self-esteem were almost as good a predictor of student performance ratings as the student's self-reported self-esteem. In the same study, Boehnke also found that teachers' evaluations of students' grades depended strongly on the teachers' evaluations of the students' obedience, while objectified intelligence measures were no strong predictor of school performance evaluations. Obviously school grades are not just measures of achievement and abilities, but to a sizeable degree a measure of social adjustment in the school environment. This understanding makes the culture-specific impact of achievement values on grades, but not (so much) test scores plausible. Values are culturally defined motivational goals, achievement values reflecting the striving to demonstrate competence *in interaction with other people* (Schwartz & Boehnke, 2004). This striving is satisfied more or less simultaneously when a student is rewarded publicly through good grades in school. Good test scores are less prone to demonstrate competence in everyday interaction; they are not clearly linked to interaction, but are a more "private" measure of competence.

Demonstrating competence in everyday interaction, however, is a desirable and rewarding behavioral orientation in cultures where "being better than others" (van de Vliert, 1998) is a highly cherished outlook on life. This second provision makes it plausible that a sizable positive relationship between achievement values and academic performance measured in school grades is found in Israel, and even more pronouncedly in Canada, countries with high achievement value preferences. In Germany, where achievement is a less preferred value, achievement values tend to have a more negative effect on academic performance.

All evidence taken together, (1) achievement values have a more positive impact on the grading of academic performance in cultures with a high average preference of these values; (2) achievement values have a more negative impact on the grading of academic performance in cultures with a low preference for these values; (3) relationships between achievement value preferences and mathematical ability scores (as measured by TIMSS tasks) are, in essence, the same, but on a *much* lower level.

Two major provisos have to be voiced. The first is that effect sizes were low as far as achievement values are concerned, although other interrelations have proven to be high (like the one between mathematical self-esteem and grades, or between manifest anxiety and self-esteem). The second is, of course, that all data are cross-sectional. This means that all causally formulated conclusions must remain inconclusive from a formal point of view. What is needed are controlled (quasi-)experimental studies taking into consideration variables of the cultural learning context, thereby extending the narrow psychological paradigm of controlled studies on the interrelation of self-esteem and performance to include the sociological determinants of learning.

The present study lends support to Eccles's findings of high achievement values being an important focusing device on the path to good academic performance. However, such values also seem to have negative potential when they are a building block of "perfectionism" (Hill et al., 2004; Hewitt & Flett, 1991). A question – conceptually – not addressed in sufficient detail here is whether the differentiation between "good" and "bad" potentials of achievement values is something that differentiates between individuals or between situations intraindividually. Is it that for some adolescents (more in high achievement than in low achievement cultures) achievement values are an exclusively positive focusing device, while for others it is exclusively a negative focusing device, or is it the case, that under certain educational micro-conditions students are more prone to utilize their (high) achievement values in the attainment of high self-esteem and good grades, and that under other educational micro-conditions such value preferences are more prone to produce a lower self-esteem and worse grades. Here further analyses and additional research are needed.

Another open question is whether it would not normatively be desirable to bring grading and ability testing into a closer nexus. In the present study the amount of common variance varied between 3.0% in Israel and 8.8% in Canada. Beyond normative decisions (as basing grades exclusively on standardized tests), here also further analyses and additional research are needed: Under which circumstances is the discrepancy particularly large, and under which circumstances is it relatively low?

All in all, one can say that the relationship between achievement values and academic performance as a behavior measure is not overly strong. The uncorrected absolute indirect effect (be it positive of negative) lies at around r=.14[7] in the overall sample. Bardi and Schwartz (2003) report an r=.20 correlation for achievement values and achievement behavior. This means that the findings from the present study should not be overestimated, they just serve as a means to alert educational researchers to the possibly ambiguous role of achievement values in the generation of high academic performance.

Notes

1 German students were randomly assigned a specific percentage point within the range designated for letter grades in Canada.

2 This means that the path from grade to mathematical test score and the reversed path were determined and the higher of the two was inserted into the model, regardless of a significant difference between the two.

3 Loadings of items on their respective latent constructs vary between .53 and .83 for achievement values, between .70 and .78 for parental achievement expectations, between .37 and .58 for manifest anxiety, and between .64 and .83 for mathematical self-esteem.

4 Calculated as the product of the path from achievement values to mathematical self-esteem, β=.22, and the path from mathematical self-esteem to grades in mathematics, β=.59.

5 Loadings and error terms were allowed to vary freely.

6 If results are seen as evidence for six out of six possible hits (results conforming with assumptions of 'below the grand mean of pertinent paths' and 'above grand mean of pertinent paths'), the exact binomial probability for such a result is p=.031, the point probability is p=.016.

7 Corrected in the suggested way, this stands for a correlation of r=.20.

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Cette article est consacrée au rôle que joue la réussite dans la performance en mathématiques estimée par les notes et les résultats de tests. Lors d'une étude comparative de 1665 élèves, âgés de 14 ans, originaires d'Allemagne, d'Isra¸l et du Canada, deux hypothèses ont été testées. Premièrement, on suppose que la réussite a un double rôle dans les résultats universitaires. D'une part, la réussite engendre le respect de soi, qui est lui-même une variable du succès universitaire. D'autre part, suite à la pression exercée par leurs parents, on attend d'eux une plus grande sensibilisation à la notion de succès. Cette pression parentale est également responsable d'une anxiété croissante, c'est pourquoi, l'estime de soi baisse. Deuxièmement, on suppose qu'il y a des variations culturelles dans l'intensité des des deux effets postulés. Le "rôle positif" de réussite est plus prononcé dans les cultures qui ont une attitude positive envers le succès (Canada, Israël), alors que le "rôle négatif" est plus prononcé dans les cultures qui ont une attitude moins positive envers le succès (Allemagne). Les hypothèses ont été testées dans le cadre des modèles des équations structurelles, et ont été pour l'essentiel confirmées. Toutefois, la grandeur des effets est réduite et la conformation des hypothèses est seulement relative aux notes et non pas aux facultés en mathématiques.

Key words: 14-year-olds, Achievement values, Cross-cultural, Mathematics, Self-esteem.

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