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Extending the Internal/External Frame of Reference Model to Social Studies: Self-Concept and Achievement in History and Politics

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Abstract

Two studies with German secondary school students extend the internal/external frame of reference (I/E) model to multiple school subjects, by including history and politics as social studies subjects. Study 1 assessed students' self-concepts and achievements related to math, German, history, English (students' first foreign language), and physics. The cross-paths leading from history self-concept to math and verbal achievements and those leading from math and verbal achievements to history self-concept were non-significant arguing against the operation of dimensional comparison processes between math and verbal achievements in the formation of history self-concept. Study 2 included measures for students' self-concepts and achievements in math, English, physics, and politics as well as a history achievement. Politics achievement and self-concept were unrelated to math, English, and physics achievements and self-concepts. History achievement was positively related with politics self-concept. This finding indicates dimensional comparison processes leading to assimilation effects within the domain of social studies.

Keywords: academic self-concept; academic achievement; dimensional and social comparisons; I/E model; social studies

1. The Domain Specificity of Academic Self-Concept

1.1 The Internal/External Frame of Reference Model

In the classic self-concept model proposed by Shavelson, Hubner, and Stanton (1976), academic self-concept was conceptualized as a global factor encompassing self-concepts for different school subjects. However, subsequent empirical research has consistently found a low or even near-zero correlation between math and verbal self-concepts implicating a strong domain specificity of academic self-concepts (Marsh, 1986, 1990a; Möller, Pohlmann, Köller, & Marsh, 2009). This observation was surprising since math and verbal achievements are highly correlated which was expected to lead to a similarly high correlation between math and verbal self-concepts as the subjective perceptions of these achievements.

The internal/external frame of reference (I/E) model was established to offer a theoretically and empirically testable framework to explain the formation of separate math and verbal self-concepts (Marsh, 1986, 1990a; Marsh, Abduljabbar et al,, 2015; Marsh & Hau, 2004; Möller et al., 2009). According to this model, the formation of domain-specific academic self-concepts relies on the simultaneous operation of two types of achievement comparison processes, i.e., social and dimensional achievement comparison processes. In a social comparison process, students compare their own achievement in one subject with their classmates' achievement in the same subject. In the dimensional comparison process, students compare their own achievement in one subject (e.g., math) with their own achievement in another subject (e.g., language; Möller & Marsh, 2013). Methodologically, empirical tests of the I/E model encompass a regression model estimating the paths leading from domain-specific (math, verbal) achievements to domain-specific (math, verbal) self-concepts while controlling for the other relations (Figure 1a). Given the high relation between math and verbal achievements, social comparison processes result in a high correlation between math and verbal self-concepts and in positive paths between achievements and self-concepts of matching domains (e.g., math achievement and math self-concept). The dimensional comparison process results in negative cross-paths between math and verbal achievements and self-concepts. As such, high levels of math (verbal) achievement lead to lower levels of verbal (math) self-concept. Moreover, the dimensional comparison process invokes a negative correlation between math and verbal self-concepts which balances the positive correlation resulting from the social comparison process, thus leading to the consistently found low or near-zero correlation between math and verbal self-concepts.

1.2 Assimilation and Contrast Effects

Originally, the I/E model only included math and verbal achievements and self-concepts in order to respond to the consistently found negligible correlation between math and verbal self-concepts despite a substantial correlation between math and verbal achievements (Marsh, 1986, 1990a; Möller et al., 2009). In this case, the operation of dimensional achievement comparison processes becomes obvious in the negative cross-paths between achievements and self-concepts of non-matching subjects (e.g., between math achievement and verbal self-concept).

Recently, the I/E model has been extended to multiple school subjects (Jansen, Schroeders, Lüdtke, & Marsh, 2015; Marsh et al., 2014; Marsh, Lüdtke et al., 2015; Marsh & Yeung, 2001; Möller, Streblow, Pohlmann, & Köller, 2006; Figure 1b). When including multiple school subjects in the I/E model, cross-paths between self-concept and achievement measures of non-matching domains (depicting dimensional achievement comparison processes) have been found to be negative as well as positive. Hence, dimensional achievement comparison processes can lead to contrast effects (negative cross-paths) or to assimilation effects (positive cross-paths). In the case of contrast effects, dimensional comparison processes evoke positive consequences for one subject (e.g., high math self-concept given high math achievement) and negative consequences for the contrasted subject (e.g., low verbal self-concept given high math achievement). In the case of assimilation effects, dimensional comparison processes induce positive consequences for both subjects concerned (e.g., high math and physics self-concepts given high levels of math and physics achievements, Jansen et al., 2015; Marsh, Lüdtke et al., 2015).

1.3 Self-Concepts in Social Studies

History and politics constitute two commonly taught school subjects in the domain of social studies at least in secondary school and students are found to exhibit domain-specific self-concepts in history (Brunner et al., 2010; Schilling, Sparfeldt, & Rost, 2006) and politics (Krampen, 1990, 1998). Although recent studies have extended the I/E model to multiple school subjects, these studies have paid little attention to the inclusion of history and politics. Respective studies would, however, provide insight into whether dimensional achievement comparison processes are involved in the formation of students' history and politics self-concepts.

So far, only one study (i.e., Study 2 by Marsh, Lüdtke et al., 2015) has presented an I/E model extended to six school subjects including history. The findings of this study demonstrated a substantial positive relation between history achievement and history self-concept, supporting the construct validity of history self-concept and replicating positive within-domain relations between self-concept and achievement (Huang, 2011; Marsh & Craven, 2006; Swann, Chang-Schneider, & Larsen McClarty, 2007; Valentine, DuBois, & Cooper, 2004). History self-concept was further found to be negatively affected by math and biology achievements indicating contrast effects. The paths leading from the other domain-specific achievements (i.e., German, English, and physics achievements) to history self-concept were not statistically significant. History achievement, in turn, did not demonstrate any significant relations to non-matching domain-specific self-concept facets (i.e., German, English, biology, math, and physics self-concepts). Hence, based on these findings, the role of dimensional comparison processes involving history remains unclear and should be subject to further research. However, other studies on history self-concept (Brunner et al., 2010; Schilling et al., 2006) only considered correlations among self-concepts or correlations between self-concept and achievement measures and are thus not adequately suited to provide insights into dimensional achievement comparison processes at play in the formation of history self-concept. Hence, there seems to be a need for further studies extending the I/E model to history in order to replicate the findings from Marsh, Lüdtke et al. (2015) when using other student samples and self-concept measures.

To our knowledge no study has so far integrated politics into an I/E model. The few studies on political self-concept examined its construct validity and mean level changes and stability across adolescence (Krampen, 1990, 1998). The relations of politics self-concept to other domain-specific academic self-concept and achievement measures were not examined; thus the role of dimensional achievement comparison processes in the formation of political self-concept has yet remained unresolved.

1.4 The Marsh/Shavelson Model of Academic Self-Concept

The Marsh/Shavelson model of academic self-concept (Marsh, 1990b) depicts the internal structure of domain-specific academic self-concepts. According to this model, math and verbal self-concepts represent the endpoints of a continuum of academic self-concepts. Self-concepts for other school subjects (e.g., physics, biology, foreign language) are assumed to be located somewhere between these two endpoints. Hence, self-concepts for different school subjects can be either more verbal-like and thus located closer to the verbal endpoint, or more math-like and located closer to the math endpoint.

Previous studies integrated the I/E model and its extension to multiple school subjects and the Marsh/Shavelson model of academic self-concept (Jansen et al., 2015; Marsh et al., 2014; Marsh, Lüdtke et al., 2015). The observation of contrast and assimilation effects resulting from extended I/E models was used to locate domain-specific self-concepts on the math-verbal continuum of academic self-concepts. In the case of contrast effects, subjects are assumed to be located far from each other on the math-verbal continuum. The prototypic example concerns math and verbal subjects. Math and verbal achievement and self-concept measures have consistently been found to be negatively related to each other, and this contrast effect has served to place math and verbal self-concepts at the opposite ends of a continuum of academic self-concepts. Smaller contrast effects were observed for physics and verbal subjects. Physics (verbal) achievement and verbal (physics) self-concept have also been found to be negatively related to each other, but the respective negative cross-paths were smaller in size compared to the cross-paths between pure math (verbal) achievement and pure verbal (math) self-concept (Jansen et al., 2015; Marsh, Lüdtke et al., 2015). This finding has been taken as evidence that physics and verbal self-concepts are still positioned at opposite ends of the math-verbal continuum with physics self-concept being located next to the math endpoint. Yet, physics and verbal self-concepts seem to be closer to each other than pure math and verbal self-concepts, the latter representing the extreme opposite endpoints.

In the case of assimilation effects, the domains involved are assumed to be located near each other on the math-verbal continuum. Assimilation effects can be demonstrated for native and foreign languages as students' native (foreign) language achievement was found to be positively related to students' self-concept regarding foreign (native) language (Marsh et al., 2014; Möller, Streblow, Pohlmann, & Köller, 2006). Therefore, self-concepts for students' native and foreign languages might be located near each other, close to the verbal end-point of the continuum. Assimilation effects have also become evident in positive relations between achievements and self-concepts in chemistry, physics, and math (Jansen et al., 2015). Hence, chemistry and physics (i.e., science) self-concepts seem to be located near the math end of the math-verbal continuum of domain-specific self-concepts.

The investigation of whether history and politics self-concepts reveal contrast or assimilation effects in their relations to other domain-specific self-concept and achievement measures in an extended I/E model might help specify their location on the math-verbal continuum of academic self-concepts as proposed in the Marsh/Shavelson model (Marsh, 1990b). In the original version of this model, self-concept in social studies was proposed to be located nearer the verbal endpoint (Marsh, 1990b). However, the findings from the only study that has so far included history in an I/E model (Marsh, Lüdtke et al., 2015) can only partially support this assumption for history self-concept. The negative relation between math achievement and history self-concept indicates a contrast effect and thus indeed argues in favor of history self-concept being verbal-like. However, this conclusion was not corroborated by simultaneously occurring assimilation effects between achievement and self-concept measures for history and verbal subjects. Hence, further research seems necessary on the location of history self-concept on the math-verbal continuum of domain-specific academic self-concepts.

Such research should be complemented by studies on politics self-concept as another facet of the domain of social studies. So far, to our knowledge no studies have included politics in an I/E model. However, respective studies might assist in gaining insight in the position of politics self-concept on the math-verbal continuum of academic self-concepts as assumed in the Marsh/Shavelson model.

2. The Present Study

Recently, the I/E model has been extended to various school subjects to investigate the operation of dimensional achievement comparison processes in the formation of domain-specific self-concepts. At the same time, subjects from the domain of social studies such as history or politics have largely been neglected in this line of research with the exception of one study that included history self-concept (Marsh, Lüdtke et al., 2015). To address this research gap, the present investigation focuses on two studies extending the I/E model to multiple school subjects including history (Study 1) and politics (Study 2). Therefore, the present study aims to provide insight into assimilation and contrast effects presumably at play in the formation of history and politics self-concepts. It thus contributes to and expands on contemporary research on the I/E model and dimensional comparison processes (Möller & Marsh, 2013). Moreover, findings might help clarify the position of history and politics self-concept on the math-verbal continuum of domain-specific self-concept as conceptualized in the Marsh/Shavelson model of academic self-concepts (Marsh, 1990b).

Both studies were conducted with German secondary school students. In the German educational system, history and politics are treated as separate subjects with history targeting the past and politics addressing the contemporary (home) political system, foreign affairs (e.g., foreign institutions and relations), and social issues. History and politics can be taught integratively or alternately contingent upon students' grade level, school track, or regulations in the different German federal states. The students in the samples considered here experienced history and politics as self-contained school subjects at the time of participation in the studies.

3. Study 1: History

3.1 Method

3.1.1 Sample. The sample of Study 1 consisted of 271 German students [N = 122 (45%) male; N = 149 (55%) female] from the federal state of Schleswig-Holstein in Northern Germany attending grade levels 7 to 10 [grade 7: N = 97 (35.8%); grade level 8: N = 67 (24.7%); grade 9: N = 76 (28.0%); grade 10: N = 31 (11.4%)] of the academic track of German secondary schools. As expected for these grade levels, students' age ranged from 11 to 17 years (M = 13.41; SD = 1.22). All steps required to obtain permission for study implementation were taken and approval to realize the study was finally granted by the responsible school authorities. Informed consent was obtained from the parents of the participating students, and students were informed about the purpose of the study, the voluntary nature of participation, and the confidential treatment of the collected data.

3.1.2 Measures. Students' self-concept was measured with respect to five school subjects, i.e., German (students' native language), English (students' first foreign language), math, physics, and history, applying four items for each subject with parallel item wordings across the subjects ("[German/English/math/physics/history] just suits me"; "Compared to others, I am good at [German/English/math/physics/history]"; "Tasks in [German/English/math/physics/history] are easy for me"; "As far as [German/English/math/physics/history] is concerned, I learn very quickly"). The items were rated on a 4-point Likert-type scale (1="does not apply at all" to 4="fully applies") in order that higher values indicated higher levels of self-concept. All scales demonstrated good reliability estimates: German: α = .898; English: α = .897; math: α = .940; physics: α = .936; history: α = .936. In the subsequent analyses conducted within the framework of structural equation modeling (SEM), the four items forming one scale were used as indicators to define the corresponding latent factors of domain-specific academic self-concepts.

Achievement was measured by the school grades the students had received in the same five school subjects (i.e., German, English, math, physics, and history) in their latest school report. In Germany, school grades range from 1 to 6 with 1 presenting the best, and 6 presenting the poorest grade. For ease of interpretation, school grades were reversely coded before all analyses in order that higher values depicted higher levels of achievement. In the latent analyses, school grades served as single-item indicators to derive domain-specific achievement factors.

3.1.3 Statistical analyses. All models were conducted using *Mplus 7.4* (Muthén & Muthén, 1998-2015) and estimated by using the maximum likelihood estimator with robust standard errors and fit statistics (i.e., the MLR option in *Mplus*). The MLR estimator is robust against violations of normality assumptions of the measured variables and sensitive to the treatment of categorical variables originating from the Likert scale response format as continuous variables (Beauducel & Herzberg, 2006). Given the parallel wordings of the items used to measure students' self-concepts in the five school subjects, correlated uniquenesses were integrated in all models to take shared method variance into account (Marsh et al., 2013). The small amount of missing data (self-concepts: German: 0.00%; English: 0.00% to

0.74%; math: 0.00% to 0.37%; physics: 0.00% to 0.74%; history: 0.00% to 0.74%; achievements: German: 0.37%; English: 0.00%; math: 0.00%; physics: 1.11%; history: 0.00%) was taken into account by the full maximum likelihood estimator (FIML) implemented in Mplus, which is known as an efficient and trustworthy method of handling missing data (Enders, 2010; Graham, 2009).

The analyses for Study 1 consisted of two main sets of models. The first set of models bases on the classic I/E model and thus only adds history self-concept and achievement to math and verbal (German) self-concepts and achievements. The second set of models considered all five subject domains available in the data set (i.e., math, English, German, physics, and history) and thus extended the I/E model to multiple school subjects, including history. These two sets of models each started with a confirmatory factor analytic (CFA) model stating separate factors for achievements and self-concepts in the considered domains and then proceeded with latent regression models. The regression models followed the I/E model framework in which the different domain-specific self-concept factors were regressed on the different domain-specific achievement factors. These two model approaches (i.e., the CFA model and the I/E model-like regression model) are statistically equivalent leading to the same model fit because the correlations of the CFA model are only replaced by path coefficients in the latent regression model. We argue in favor of regression models as the appropriate approach to studying dimensional comparison processes in the formation of domain-specific academic self-concepts, since regression models estimate the paths leading from domain-specific achievements to domain-specific academic self-concepts while controlling for the other relations. Thus, we report the findings from the regression models in the main manuscript, while the results from the complementary CFA models are reported in the Online Supplements.

For the purpose of model evaluation, we follow the commonly accepted recommendation to simultaneously consider a wide range of descriptive goodness-of-fit indices (e.g., Marsh, Hau, & Wen, 2004). Accordingly, we report the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). For the CFI and TLI, values above .90 and .95 represent an adequate respectively good model fit (Hu & Bentler, 1999). For the RMSEA, values should be below .05 for a close fit, or between .05 and .08 for a reasonable fit (Browne & Cudeck, 1993). Regarding the SRMR, Hu and Bentler (1999) propose values below .08 for a good model fit although others (e.g., Kline, 2005) also accept values below .10.

3.2 Results

Model 1 (Table 1) is the I/E regression model including math, German, and history achievement and self-concept factors. The good model fit supports the integrity of the used measures as well as the separation between domain-specific self-concept and achievement factors (see also Table S1 of the Online Supplements). The results (Tables 2 and 3) reproduced the classic I/E model with positive within-domain relations and negative cross-domain relations between math and German achievements and self-concepts. In essence, math achievement was positively related to math self-concept ($\beta = .659$, $p < .001$), but negatively related to German self-concept ($\beta = -.204$, $p = .001$). In parallel, verbal achievement was positively related to German self-concept ($\beta = .538$, $p < .001$), but negatively related to German self-concept ($\beta = -.184$, $p < .01$). Math and verbal self-concepts demonstrated a non-significant negative correlation ($r = -.122$, *ns*), while math and verbal achievements were substantially positively correlated ($r = .531$, $p < .001$). For history, only the positive within-domain relation between self-concept and achievement was found ($\beta = .580$, $p < .001$). Math and verbal achievements did not show significant relations to history self-concept. In addition, history achievement was not related to math or verbal self-concepts.

When further including achievement and self-concept factors for English (foreign language) and physics (Model 2 in Table 1; Table S2 of the Online Supplements), the relatively strongest relations appeared between achievements and self-concepts of matching domains. Contrast effects (i.e., negative cross-paths for the achievement–self-concept relations) were most prominent between math and German achievements and self-concepts (math achievement → German self-concept: $\beta = -.217$, $p = .001$; German achievement → math self-concept: $\beta = -.147$, $p < .05$; see Table 2). Contrast effects were also found for other relations between math-like (i.e., math, physics) and verbal-like (i.e., English, German) achievement and self-concept measures, some of which were statistically significant (English achievement → math self-concept: $\beta = -.169$, $p < .01$; English achievement → physics self-concept: $\beta = -.179$, $p < .01$; German achievement → physics self-concept: $\beta = -.201$, $p < .01$), while others were non-significant but tended toward the expected negative direction (physics achievement → German self-concept: $\beta = -.007$, *ns;* physics achievement → English self-concept: $\beta = -.055$, *ns*; math achievement → English self-concept $\beta = -.101$, *ns*).

Assimilation effects in terms of positive achievement–self-concept relations across non-matching domains were evident from a positive regression of physics self-concept on math achievement ($\beta = .160$, $p < .05$), and from a positive, albeit non-significant, regression of physics achievement on math self-concept ($\beta =.083$, *ns*). There was no indication of assimilation effects between German and English given a non-significant effect of English achievement on German self-concept ($\beta = .050$, *ns*) and even a significant negative effect of German achievement on English self-concept ($\beta = -.128$, $p < .05$).

Regarding history self-concept, the results did not demonstrate assimilation or contrast effects. Concretely, English ($\beta = -.024$, *ns*), math ($\beta = -.123$, *ns*), and German ($\beta = -.121$, *ns*) achievements had negative and non-significant effects on history self-concept, while physics achievement had a positive and non-significant effect ($\beta = .105$, *ns*). History achievement did not demonstrate any relations to students' self-concepts in German ($\beta = .050$, *ns*), English ($\beta = .033$, *ns*), and math ($\beta = .071$, *ns*), but showed a positive effect on physics self-concept ($\beta = .180$, $p < .01$).

3.3 Discussion

Study 1 presents two I/E models including history as a so far underexplored school subject in research on I/E models extended to multiple school subjects and dimensional achievement comparison processes. The findings of both models did not argue for the involvement of assimilation or contrast effects in the formation of history self-concept as history self-concept was not found to be substantially related to achievements in other school subjects. Hence, students do not seem to consider information about their achievements in other school subjects when establishing their history self-concept. History achievement was not found to yield significant effects on any non-matching domain-specific academic self-concept except physics self-concept. This finding indicates that history achievement and its comparison to other domain-specific achievements are not considerably involved in the formation of domain-specific academic self-concepts.

4. Study 2: Politics

4.1 Method

4.1.1 Sample. The sample of Study 2 was retrieved from the large-scale longitudinal project "Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood (BIJU)" conducted under the aegis of the Max Planck Institute for Human Development, Berlin, Germany. As the measures of interest for the present study were not applied at all measurement points, we only focus on the fourth measurement point which was realized in grade level 10. In order to ensure comparability to Study 1, only students attending the academic track of the German secondary school system who learned English as their first foreign language were considered. The sample consisted of 873 students [518 (59.3%) female; 346 (39.6%) male; 9 (1.0%) no gender indicated] from four federal states in Germany (i.e., Berlin, North Rhine-Westphalia, Mecklenburg-Western Pomerania, and Saxony-Anhalt). Prior to conducting the study, approval processes as required in the different federal states were properly run involving all relevant school authorities and stakeholders. Furthermore, informed consent was obtained from the parents of the participating students, and students were informed about the purpose of the study, the voluntary nature of participation, and the confidential treatment of the collected data.

4.1.2 Measures. Students' self-concepts in specific school subjects were measured with respect to politics, English (students' first foreign language), math, and physics. To measure politics self-concept, four items were taken from the "Trierer Inventar zur politischen Partizipation Jugendlicher" (TIPP-H; Krampen 1988; i.e., "Thinking in political contexts suits me"; "As far as the discussion of politics is concerned, I can actually always find something to say"; "I find it easy to understand political matters"; "Participation in debates on political topics is easy for me"). Students had to respond on a four point Likert scale whether the item statements were totally true (1), more probably true (2), more probably not true (3), or not true (4). For ease of interpretation, the items were recoded before the analyses so that high values indicated high levels of politics self-concept. This scale demonstrated a good reliability estimate of $\alpha = .910$.

The scales assessing students' self-concepts in English, math, and physics each encompassed five items which were formulated in parallel across these subjects (i.e., "Nobody's perfect, but I'm just not good at [English/math/physics]"; "I would much prefer [English/math/physics] if it weren't so hard"; "[English/math/physics] just isn't my thing"; "Some topics in [English/math/physics] are just so hard that I know from the start I'll never understand them"; "Although I make a real effort, [English/math/physics] seems to be harder for me than for my fellow students"). The same Likert scale as applied for politics self-concept was used as a response scale so that high values a priori indicated high levels of English, math, and physics self-concepts. The reliability estimates were good for these three scales: English: $\alpha = .926$; math: $\alpha = .877$; physics: $\alpha = .889$. The items of the different scales for the domain-specific academic self-concept facets were used as indicators for the corresponding domain-specific academic self-concept factors in the subsequent SEM analyses.

Students' achievement was measured for politics, English, math, and physics, hence all domains with corresponding self-concept measures. In addition, students' achievement in history was measured. In parallel to Study 1, students' reversely coded school grades obtained in these subjects served as single-item indicators to define the domain-specific achievement factors in the latent analyses.

4.1.3 Statistical analyses. Similar to Study 1, CFA models and I/E model-like latent regression models were first conducted when only considering math, verbal (English), and politics. Afterwards, physics was included in order to test an I/E model extended to four school subjects. This model was expanded by including history achievement in a third step as it is interesting to study the relations between history achievement and politics self-concept to probe for potential assimilation effects within the social studies domain.

All models used MLR estimation and included correlated uniquenesses between the self-concept items that were worded in parallel across English, math, and physics (Marsh et al., 2013). The amount of missing values was low on the items measuring politics (5.56% to 5.73%) and math self-concepts (1.15% to 2.41%), and on the achievement measures for math (2.52%), English (2.86%), physics (4.47%), and history (3.44%). Higher percentages of missing values were found for the items measuring physics self-concept (13.75% to 14.09%), English self-concept (50.52% to 50.86%), and for achievement in politics (43.41%). These substantial amounts of missing data originate from specific features of the study design, according to which the self-concept and achievement measures for some subjects were rotated within a class. Hence, one subsample of students only completed the measures for one subject while another subsample of students only completed measures for another subject. FIML can be seen as an adequate and reliable procedure to handle this pattern of missing data and has been found to result in unbiased parameter estimates even in the case of a high amount of missing data (Enders, 2010; Graham, 2009).

The participating students of this study were nested within 82 classes. We defined students' classes as a cluster variable and conducted all analyses by applying the type=complex option in *Mplus* which corrects for possibly biased standard errors due to the hierarchical nature of the data. Using the same approach as in Study 1, model evaluation was based on the consideration of a wide range of goodness-of-fit indices (Marsh et al., 2004).

4.2 Results

The results of Model 1 (Table 1; see also Table S3 of the Online Supplements) including English, math, and politics replicated the classic I/E model assumptions given the found positive within-domain (Table 4; math: $\beta = .781$, $p < .001$; English: $\beta = .615$, $p < .001$), and negative cross-domain (math achievement → English self-concept: $\beta = -.301$, $p < .001$; English achievement → math self-concept: $\beta = -.219$, $p < .05$) achievement–self-concept relations for math and verbal measures indicating contrast effects. Furthermore, a negligible correlation was apparent between math and English self-concepts ($r = .043$, *ns*), but a significant positive correlation between math and English achievements ($r = .355$, $p < .001$; Table 5). The paths leading from math and English achievements to politics self-concept were non-significant. Moreover, achievement in politics did not demonstrate any significant relations to math and verbal self-concepts.

When extending the I/E model to four school subjects (i.e., English, math, physics, and politics; Model 2 in Table 1; see also Table S4 of the Online Supplements), the findings (Table 4) replicated the pattern of the classic I/E model for verbal (English) and math achievement–self-concept relations. Another contrast effect was found between English and physics as evident in the significantly negative path from English achievement to physics self-concept ($\beta = -.163$, $p < .001$). An assimilation effect could be demonstrated between physics and math given the positive path from physics achievement to math self-concept ($\beta = .091$, p

< .05). Considering politics, there was only a significant within-domain relation between politics achievement and politics self-concept (β = .443, p < .001). There were no significant cross-paths from the other domain-specific achievements to politics self-concept or from politics achievement to the other domain-specific self-concepts.

When additionally including history achievement (Model 3 in Table 1; Table 4; see also Table S5 of the Online Supplements), history achievement was found to be positively related to self-concept in politics (β = .237, p < .001) indicating an assimilation effect. However, history achievement did not demonstrate any further relations with other domain-specific academic self-concept facets.

4.3 Discussion

Study 2 examined students' politics self-concept which so far has never been integrated in an I/E model and examined with respect to contrast and assimilation effects. Achievement in politics was positively related to politics self-concept. Achievement in politics was, however, not significantly related to math, English, and physics self-concepts. Hence, achievement in politics does not seem to play a role in the formation of non-matching domain-specific self-concept facets. Politics self-concept was not related to achievements in English, math, and physics, but showed a positive relation with achievements in politics and history. The latter finding is indicative of an assimilation effect between history and politics operating within the domain of social studies. Students thus seem to consider both their achievements in history and politics to infer their politics self-concept.

5. General Discussion

While the original I/E model only focused on the juxtaposition of math and verbal self-concept and achievement measures, recent self-concept research has extended the I/E model to multiple school subjects (Jansen et al., 2015; Marsh et al., 2014; Marsh, Lüdtke et al., 2015; Möller, Streblow, Pohlmann, & Köller, 2006). This line of research is characterized by a special focus on and interest in dimensional achievement comparisons (Möller, Helm, Müller-Kalthoff, Nagy, & Marsh, 2015; Möller & Marsh, 2013) which can lead to positive (assimilation effect) or negative (contrast effect) relations between achievements and self-concepts of non-matching domains. Respective studies, however, have so far neglected the domain of social studies although history and politics are common secondary school subjects. Therefore, the present study tested I/E models extended to multiple school subjects including history (Study 1) and politics (Study 2). It was thus possible to gain first insights into contrast and assimilation effects presumably at play in the formation of students' self-concepts in history and politics.

In Study 1, history self-concept was not found to be notably affected by achievements in math-like (math, physics) or verbal-like (English, German) school subjects. Politics self-concept did not demonstrate relations to English, math, and physics achievements in Study 2. Hence, the present findings suggest some similarities between history and politics self-concepts as students do not seem to compare their achievements in history and politics to their achievements in math-like and verbal-like school subjects when establishing their history and politics self-concepts. Hence, dimensional comparisons involving math and verbal achievements do not seem to be instrumental in forming students' history and politics self-concepts.

Study 2 demonstrated a substantial relation between history achievement and self-concepts in politics arguing for an assimilation effect within the domain of social studies. Hence, high achievement in history might be facilitative for students' self-concept in history (Study 1) but also for students' self-concept in politics (Study 2). Dimensional achievement comparison processes leading to assimilation effects might thus still be involved in the establishment of history and politics self-concepts, but they seem to be restricted to the domain of social studies itself, not involving other (math-like and verbal-like) domains. Since a measure for history self-concept was not available in the data set of Study 2, future studies are necessary to examine the relation between politics achievement and history self-concept.

A positive relation would provide further support for the conjecture of assimilation effects between self-concepts and achievements related to subjects from the domain of social studies.

Previous studies on extending the I/E model to multiple school subjects (e.g., Jansen et al., 2015; Marsh et al., 2014; Marsh, Lüdtke et al., 2015) have used findings on assimilation and contrast effects to gain insights into the location of domain-specific academic self-concepts on the math-verbal continuum as assumed in the Marsh/Shavelson model (Marsh, 1990b). In our study, there were no clear assimilation or contrast effects between history and politics on the one hand and math and verbal domains on the other hand. This finding indicates that history and politics self-concepts might depict separate self-concept facets which seem to be located at the center of the math-verbal continuum. Rather than being more closely linked to either the verbal or the math endpoint, history and politics self-concepts seem to be similarly, albeit loosely, related to both endpoints. Originally, self-concept in social studies subjects was proposed to be located nearer the verbal endpoint (Marsh, 1990b). Yet, the present findings suggest a reformulation according to which self-concepts related to the domain of social studies would be better placed at the center of the math-verbal continuum. This suggestion also matches the findings of previous work according to which history self-concept was found to be related to both math-like and verbal-like self-concept and achievement measures (Brunner et al., 2010; Marsh, Lüdtke et al., 2015; Schilling et al., 2006). Moreover, pursuant to the found assimilation effect between history achievement and politics self-concept, history and politics self-concepts should be classified as adjacent facets forming a separate category of self-concepts related to the domain of social studies.

The remaining findings from the I/E models extended to multiple school subjects presented here largely correspond to findings from previous research. Replicating the original I/E model (Möller et al., 2009), contrast effects were consistently found between math and verbal achievement and self-concept measures irrespective of whether German (students' native language) or English (students' foreign language) were used as verbal indicators.

Smaller, yet consistent contrast effects were found between German and English on the one hand and physics on the other hand. For the Marsh/Shavelson model of academic self-concept (Marsh, 1990b), these findings imply that self-concepts with regard to German and English and self-concepts with regard to math and physics are located far from each other, at opposite ends of the math-verbal continuum. An assimilation effect was found between math and physics. Since this finding occurred in many studies (Jansen et al., 2015; Marsh, Lüdtke et al., 2015; Möller, Streblow, Pohlmann, & Köller, 2006), it can be seen as robust and consistent. Hence, math and physics self-concepts seem to constitute the math end of the continuum. An assimilation effect would have also been expected between German (native language) and English (foreign language), if they were placed close to each other on the verbal end of the continuum. However, Study 1 revealed an unclear pattern since there was a positive, yet non-significant path from English achievement to German self-concept, but a significant negative path leading from German achievement to English self-concept which rather represented a contrast effect. Thereby, the pattern of findings emanating from Study 1 matches the so far mixed pattern of findings regarding the verbal domain which encompass contrast effects (Marsh, Kong, & Hau, 2001; Marsh & Yeung, 2001; Xu et al., 2013) as well as assimilation effects (Marsh et al., 2014; Möller, Streblow, Pohlmann, & Köller, 2006) between self-concepts and achievements of different languages.

The present study thus presents two challenges to the assumptions of the Marsh/Shavelson model of academic self-concept (Marsh, 1990b): the demonstrated independence of history and politics self-concepts from other math-like and verbal-like self-concept and achievement measures, and the ambiguous findings on the consequences (i.e., contrast or assimilation effects) of dimensional comparison processes between the two verbal domains of German and English. Indeed, the two-dimensional math-verbal continuum of academic self-concepts proposed in the Marsh/Shavelson model has remained hypothetical and observations of contrast and assimilation effects cannot be taken as indisputable empirical evidence. Hence, alternative conceptualizations of the internal organization of domain-specific academic self-concepts are conceivable. Students' perceived similarity versus dissimilarity between school subjects has been found to influence the consequences of dimensional comparison processes in terms of contrast and assimilation effects (Helm, Müller-Kalthoff, Nagy, & Möller, 2015; Möller, Streblow, & Pohlmann, 2006). Perceptions of similarity between two domains induce assimilation effects while perceptions of dissimilarity evoke contrast effects. Hence, rather than only locating academic self-concepts somewhere in between the math and verbal endpoints of a two-dimensional continuum, students might position domain-specific self-concepts in a multidimensional space with the distance between them varying according to the degree of perceived similarity of the domains. Qualitative studies (see for example Möller & Husemann, 2006) or person-centered approaches might be useful to gain insight into the structure and organization of domain-specific academic self-concepts in students' minds.

It should be mentioned that the internal organization of domain-specific self-concepts and the pattern of achievement–self-concept relations including contrast and assimilation effects might also vary contingent upon student characteristics or study features. Students' individual background variables including socio-economic status (SES), family practices, or home environment have been shown to be related to academic achievement (Bradley & Corwyn, 2002; Sirin, 2005). They might also affect students' approaches to achievement comparisons, for example by influencing the relevance and weighting students attribute to their level of school achievement in one subject relative to another. In addition, students' learning environment and school context might foster or weaken social and dimensional achievement comparison processes (Ames, 1992). With special regard to the social studies domain, it should be examined whether the operation and consequences of dimensional comparison processes might vary contingent upon whether history and politics are taught integratively or as separate subjects.

With respect to study features, differential findings may result contingent upon the specific combination and number of domains considered. Despite this interesting issue, it should be noticed that the classic I/E model assumptions involving math and verbal domains could be evidenced in both studies presented here irrespective of the number and combination of domains considered, making them robust findings (Möller et al., 2009). Given the cross-sectional design of the studies, temporal relations among constructs could not be investigated and should thus be inspected in future longitudinal studies (Möller, Retelsdorf, Köller, & Marsh, 2011; Niepel, Brunner, & Preckel, 2014). Study 2 included history achievement along with politics self-concept and achievement, but further studies including self-concept as well as achievement measures for both history and politics are needed. In this regard, it would be preferable to integrate even more subjects from the domain of social studies such as geography or economics. Research would benefit even more from studies that include social studies subjects along with a variety of other (math-like and verbal-like) school subjects to test largely extended I/E models. Information on students' class membership was not available in Study 1 and future studies are advised to always take the hierarchical data structure into account. Studies based on larger and more diverse samples would allow for testing the generalizability of the findings across subsamples of students from different educational contexts or cultural backgrounds.

Taken together, despite some limitations, this article enriches previous research on the extension of the I/E model to multiple school subjects by including history and politics as two subjects from the domain of social studies. It reveals a strong separation of history and politics from both math and verbal self-concept and achievement measures. It also indicates an assimilation effect within the domain of social studies which might inspire future research.

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Table 1

Goodness-of-fit Indices

		χ^2	df	CFI	TLI	RMSEA	SRMR
	Study 1						
1	I/E model with self-concept and achievement factors in three subjects (German, math, history)	101.663	66	.984	.975	.045	.031
2	I/E model with self-concept and achievement factors in five subjects (German, English, math, physics, history)	317.683	211	.976	.965	.043	.033
	Study 2						
1	I/E model with self-concept and achievement factors in three subjects (English, math, politics)	265.003	102	.975	.967	.043	.038
2	I/E model with self-concept and achievement factors in four subjects (English, math, physics, politics)	433.956	191	.974	.965	.038	.038
3	I/E model with self-concept and achievement factors in four subjects (English, math, physics, politics) and achievement in history	459.323	206	.974	.965	.038	.038

Note. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation, SRMR = standardized root mean squared residual. All models are estimated with the Robust Maximum Likelihood (MLR) estimator.
All χ^2 are significant ($p < .05$).

Table 2

Standardized Path Coefficients (and Standard Errors) of the Extended I/E Models of Study 1

	Model 1			Model 2		
Outcome: German Self-Concept	β	SE	*p*	β	SE	*p*
Math Achievement	-0.204	0.062	0.001	-0.217	0.065	0.001
German Achievement	0.538	0.064	0.000	0.524	0.069	0.000
History Achievement	0.059	0.064	0.353	0.050	0.066	0.452
Physics Achievement				-0.007	0.061	0.905
English Achievement				0.050	0.068	0.459
Outcome: Math Self-Concept						
Math Achievement	0.659	0.049	0.000	0.677	0.056	0.000
German Achievement	-0.184	0.063	0.003	-0.147	0.063	0.019
History Achievement	0.047	0.061	0.440	0.071	0.062	0.257
Physics Achievement				0.083	0.063	0.190
English Achievement				-0.169	0.060	0.005
Outcome: History Self-Concept						
Math Achievement	-0.090	0.061	0.137	-0.123	0.069	0.077
German Achievement	-0.109	0.064	0.089	-0.121	0.070	0.085
History Achievement	0.580	0.051	0.000	0.573	0.055	0.000
Physics Achievement				0.105	0.071	0.142
English Achievement				-0.024	0.067	0.722
Outcome: Physics Self-Concept						
Math Achievement				0.160	0.066	0.015
German Achievement				-0.201	0.071	0.005
History Achievement				0.180	0.065	0.006
Physics Achievement				0.546	0.056	0.000
English Achievement				-0.179	0.068	0.008
Outcome: English Self-Concept						
Math Achievement				-0.101	0.066	0.123
German Achievement				-0.128	0.063	0.041
History Achievement				0.033	0.065	0.617
Physics Achievement				-0.055	0.058	0.345
English Achievement				0.764	0.052	0.000

Table 3

Correlations between the Factor Residual Variances of the Extended I/E Models of Study 1

	German Self-Concept	Math Self-Concept	History Self-Concept	Physics Self-Concept	German Achievement	Math Achievement	History Achievement	Physics Achievement
Math Self-Concept	-.122/-.117							
History Self-Concept	.196*/.206**	-.047/-.066						
Physics Self-Concept	-/.036	-/.350**	-/.181*					
English Self-Concept	-/.311**	-/-.073	-/.145	-/.014				
Math Achievement					.531**/.531**			
History Achievement					.477**/.477**	.289**/.289**		
Physics Achievement					-/.410**	-/.485**	-/.286**	
English Achievement					-/.531**	-/.496**	-/.402**	-/.283**

Note. Coefficients before the slash are from Model 1, coefficients behind the slash are from Model 2.
** $p \leq .01$; * $p \leq .05$.

Table 4

Standardized Path Coefficients (and Standard Errors) of the Extended I/E Models of Study 2

	Model 1			Model 2			Model 3		
Outcome: English Self-Concept	β	SE	*p*	β	SE	*p*	β	SE	*p*
Math Achievement	-0.301	0.029	0.000	-0.278	0.045	0.000	-0.279	0.046	0.000
English Achievement	0.615	0.033	0.000	0.623	0.034	0.000	0.621	0.038	0.000
Politics Achievement	0.081	0.046	0.079	0.083	0.052	0.108	0.042	0.060	0.478
Physics Achievement				-0.041	0.053	0.434	-0.048	0.050	0.339
History Achievement							0.045	0.053	0.402
Outcome: Math Self-Concept									
Math Achievement	0.718	0.026	0.000	0.671	0.030	0.000	0.670	0.029	0.000
English Achievement	-0.219	0.033	0.000	-0.228	0.033	0.000	-0.227	0.032	0.000
Politics Achievement	-0.030	0.037	0.425	-0.049	0.040	0.220	-0.066	0.052	0.208
Physics Achievement				0.091	0.036	0.012	0.094	0.038	0.013
History Achievement							0.012	0.054	0.821
Outcome: Politics Self-Concept									
Math Achievement	-0.060	0.038	0.114	-0.079	0.043	0.064	-0.088	0.039	0.026
English Achievement	-0.012	0.047	0.804	-0.011	0.045	0.814	-0.046	0.044	0.299
Politics Achievement	0.444	0.047	0.000	0.443	0.046	0.000	0.309	0.057	0.000
Physics Achievement				0.031	0.045	0.483	-0.007	0.046	0.881
History Achievement							0.237	0.051	0.000
Outcome: Physics Self-Concept									
Math Achievement				0.070	0.046	0.128	0.070	0.046	0.126
English Achievement				-0.163	0.034	0.000	-0.159	0.035	0.000
Politics Achievement				-0.059	0.050	0.234	-0.020	0.054	0.708
Physics Achievement				0.460	0.039	0.000	0.466	0.040	0.000
History Achievement							-0.048	0.044	0.281

Table 5

Correlations between the Factor Residual Variances of the Extended I/E Models of Study 2

	English Self-Concept	Math Self-Concept	Politics Self-Concept	English Achievement	Math Achievement	Politics Achievement	Physics Achievement
Math Self-Concept	.043/.052/.051						
Politics Self-Concept	.097/.096/.107	.081/.084/.087*					
Physics Self-Concept	-/.140*/.140*	-/.371**/.373**	-/.216**/.222**				
English Achievement							
Math Achievement				.355**/.355**/.355**			
Politics Achievement				.395**/.385**/.405**	.289**/.293**/.298**		
Physics Achievement				-/.353**/.353**	-/.601**/.601**	-/.365**/.385**	
History Achievement				-/-/.415**	-/-/.345**	-/-/.658**	-/-/.429**

Note. The first coefficients are from Model 1, the second coefficients from Model 2, and the final coefficients from Model 3.
** $p \leq .01$; * $p \leq .05$.

Figure 1a
The traditional I/E model according to Marsh (1986)

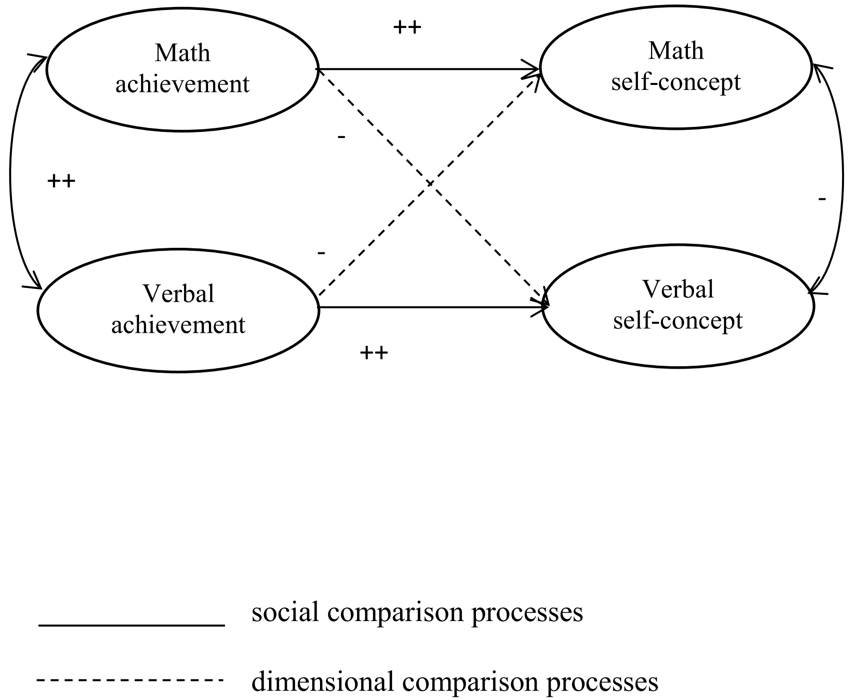
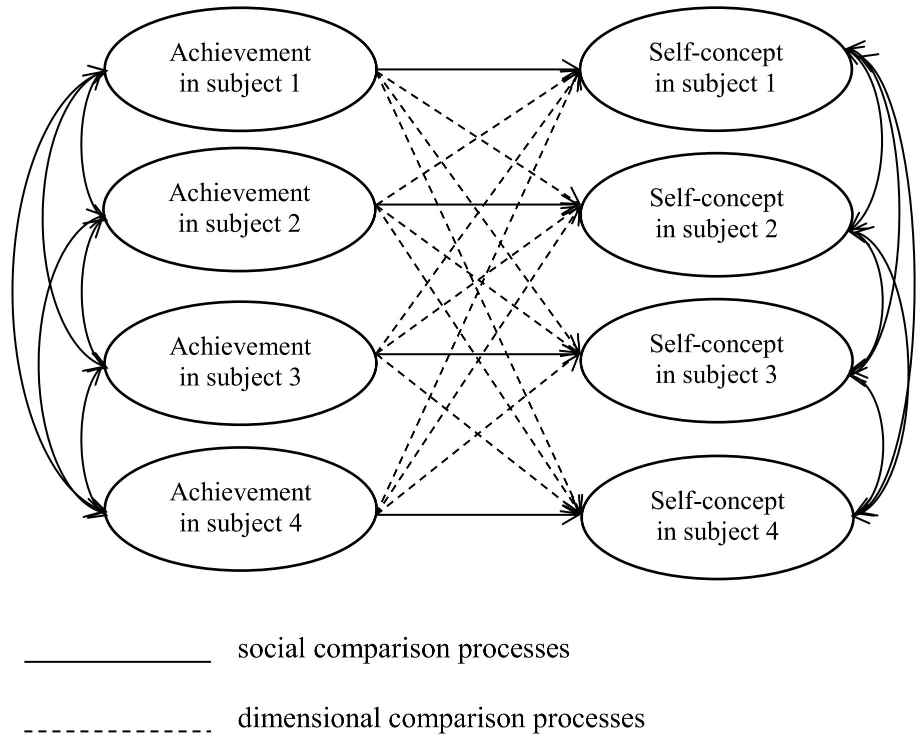


Figure 1b
The I/E model extended to multiple school subjects



Online Supplements for

"Extending the Internal/External Frame of Reference Model to Social Studies: Self-Concept and Achievement in History and Politics"

Table S1

Standardized Factor Correlations between Math, German, and History Self-Concept and Achievement Measures (Study 1)

	German Self-Concept	Math Self-Concept	History Self-Concept	German Achievement	Math Achievement
Math Self-Concept	-.093				
History Self-Concept	.236***	-.018			
German Achievement	.457***	.189***	.120*		
Math Achievement	.098	.576***	.019	.531***	
History Achievement	.256***	.150*	.502***	.477***	.289***

Note. This model is statistically equivalent with Model 1 for Study 1 of the main manuscript resulting into the same fit: χ^2 (66) = 101.663, $p < .05$; CFI = .984; TLI = .975; RMSEA = .045; SRMR = .031.

*** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$.

Table S2

Standardized Factor Correlations between Math, German, English, Physics, and History Self-Concept and Achievement Measures (Study 1)

	German Self-Concept	Math Self-Concept	English Self-Concept	Physics Self-Concept	History Self-Concept	German Achievement	Math Achievement	English Achievement	Physics Achievement
Math Self-Concept	-.094								
English Self-Concept	.316***	-.031							
Physics Self-Concept	.024	.455***	-.040						
History Self-Concept	.239***	-.021	.167*	.256***					
German Achievement	.457***	.190***	.217***	.099	.117				
Math Achievement	.098	.576***	.193**	.281***	.017	.531***			
English Achievement	.239***	.140**	.644***	.020	.111	.531***	.496***		
Physics Achievement	.131*	.323***	.069	.542***	.153**	.410***	.485***	.283***	
History Achievement	.255**	.152**	.234***	.214***	.500***	.477***	.289***	.402***	.286***

Note. This model is statistically equivalent with Model 2 for Study 1 of the main manuscript resulting into the same fit: χ^2 (211) = 317.683, $p < .05$; CFI = .976; TLI = .965; RMSEA = .043; SRMR = .033.
*** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$.

Table S3

Standardized Factor Correlations between English, Math, and Politics Self-Concept and Achievement Measures (Study 2)

	English Self-Concept	Math Self-Concept	Politics Self-Concept	English Achievement	Math Achievement
Math Self-Concept	-.142***				
Politics Self-Concept	.172***	.057			
English Achievement	.540***	.024	.143***		
Math Achievement	-.060	.632***	.065	.355***	
Politics Achievement	.237***	.092*	.422***	.395***	.289***

Note. This model is statistically equivalent with Model 1 for Study 2 of the main manuscript resulting into the same fit: χ^2 (102) = 265.003, $p < .05$; CFI = .975; TLI = .967; RMSEA = .043; SRMR = .038.

*** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$.

Table S4

Standardized Factor Correlations between English, Math, Physics and Politics Self-Concept and Achievement Measures (Study 2)

	English Self-Concept	Math Self-Concept	Physics Self-Concept	Politics Self-Concept	English Achievement	Math Achievement	Physics Achievement
Math Self-Concept	-.139*						
Physics Self-Concept	.012	.462***					
Politics Self-Concept	.169**	.059	.195***				
English Achievement	.541***	.023	.002	.143***			
Math Achievement	-.058	.630***	.272***	.065	.355***		
Physics Achievement	.041	.396***	.424***	.142***	.353***	.601***	
Politics Achievement	.226***	.093*	.067	.427***	.385***	.293***	.365***

Note. This model is statistically equivalent with Model 2 for Study 2 of the main manuscript resulting into the same fit: χ^2 (191) = 433.956, $p < .05$; CFI = .974; TLI = .965; RMSEA = .038; SRMR = .038.
*** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$.

Table S5

Standardized Factor Correlations between English, Math, Physics and Politics Self-Concept Measures and English, Math, Physics, Politics, and History Achievement Measures (Study 2)

	English Self-Concept	Math Self-Concept	Physics Self-Concept	Politics Self-Concept	English Achievement	Math Achievement	Physics Achievement	Politics Achievement
Math Self-Concept	-.141***							
Physics Self-Concept	.012	.463***						
Politics Self-Concept	.174***	.060	.198***					
English Achievement	.541***	.022	.002	.144***				
Math Achievement	-.059	.630***	.271***	.066	.355***			
Physics Achievement	.039	.396***	.424***	.145***	.353***	.601***		
Politics Achievement	.221***	.087*	.084	.418***	.405***	.298***	.385***	
History Achievement	.213***	.146***	.097*	.389***	.415***	.345***	.429***	.658***

Note. This model is statistically equivalent with Model 3 for Study 2 of the main manuscript resulting into the same fit: χ^2 (206) = 459.323, $p < .05$; CFI = .974; TLI = .965; RMSEA = .038; SRMR = .038.
*** $p \leq .001$; ** $p \leq .01$; * $p \leq .05$.