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COMPETENCE AND CONTROL ORIENTATIONS AS PREDICTORS OF TEST ANXIETY IN STUDENTS: LONGITUDINAL RESULTS*

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The hypothesis that domain-specific self-related cognitions (self-concept of own competence and control orientations) are predictors of text anxiety in students is tested by longitudinal data. At the beginning and at the end of a school year the following variables were measured twice in a sample of 346 secondary school students (grades six to ten): (1) self-concept of own competence in mathematics, (2) three aspects of locus of control for problem-solving behavior (internality, powerful others control, and chance control), (3) generalized locus of control of reinforcement, (4) test anxiety as well as manifest anxiety. The cross-sequential developmental gradients point toward symmetries in the development of self-related cognitions and test anxiety. The results of cross-lagged correlation analyses show that the null hypothesis (no causal relations exist between the self-related cognitions and test anxiety) can be rejected for the domain-specific aspects of (a low) self-concept of own competence and locus of control (low internality and high chance control), which are confirmed as preceding test anxiety. However, longitudinal results also show that findings of cross-sectional studies tend to overestimate the relations between self-related cognitions and test anxiety in a developmental perspective.

KEY WORDS: Self-related cognitions, test anxiety, longitudinal data.

Among the copious results of studies concerned with the correlates and determinants of test anxiety in students (covering a relatively broad spectrum of variables like features of educational style in family and school, school climate, type of school, reference group, etc.) recently such have increased, in which various constructs of self-related cognitions are analyzed as relevant determinants of anxiety (see, e.g., Schwarzer, 1986; Van der Ploeg, Schwarzer & Spielberger, 1984). This is founded in social cognitive approaches to personality, which differentiate between more or less complex self-related cognitions and relate them to emotional, motivational and behavioral qualities.

Despite their differences, a central assumption of such cognitive approaches (e.g., Bandura, 1986a; Lazarus & Launier, 1978; Peterson & Seligman, 1984) to emotional qualities and coping in general as well as to anxiety in particular is the hypothesis that special types or expressions of self-related cognitions accompany or precede anxiety. More accurately, it must be added, that the view of Lazarus and Launier (1978) is somewhat difficult to interpret because on the one hand they advocate cognitive primacy, on the other they advocate a transactional model of causation between cognitions and emotions. Bandura (1986a) posits a bidirectional but asymmetrical relation between perceived self-efficacy and anxiety, pointing toward the primacy of (low) self-efficacy, but processing in a dynamic cycle of anxiety arousal and decreasing self-efficacy. However, regardless of such indication of a dynamic interaction between self-related cognitions and anxiety, it is similarly assumed in different theoretical conceptions that (test) anxiety results, if a person believes (1) that

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an achievement situation/performance test will hinder the attainment of subjectively highly valued objectives or events (e.g., a good grade and its consequences), and (2) that there are no (or at least only few/weak) alternative action possibilities (low self-efficacy in the terminology of Bandura, 1986a) and (3) no (or at least only weak) possibilities of controlling the occurrence of the objective or event (outcome expectancy in the terminology of Bandura, 1986a).

It is not difficult to identify the theoretical expectancy-value basis of this hypothesis (in terms of valences, situation-action or competence expectancies, and action-outcome expectancies; see, e.g., Pekrun, 1984), which—of course—remains highly situation- and action-specific. It makes sense to extend this approach to more general self-related cognitions because the construct of test anxiety implies a more or less generalized tendency of a person to show anxiety reactions before and in achievement situations. Furthermore, achievement situations in school are more or less new and ambiguous action situations, for which at least the anxious student a priori has no adequate cognitive representations.

The social learning theory of Rotter (1982) and its extension to an action-theoretical model of personality (Krampen, 1987a, 1988) postulate that the predictive value of situation- and action-specific person variables is low and that of domain-specific or generalized personality variables is high in such subjectively ill-defined situations. Dealing with domain-specific anxiety (like test anxiety in school) therefore requires the operationalization of self-related cognitions at a medium level in a hierachical model of personality, i.e., domain-specific measurements. Moreover, the action-theoretical model of personality, which stems from the social learning theory and a differentiated expectancy-value model (Krampen, 1987a, 1988), is an integrative frame of reference for situation- and action-specific person variables (e.g., different aspects of valences and expectancies) and personality variables (e.g., self-concept, control and value orientations, etc.). Such variables have up till now been studied mainly separately or additively at best. With reference to the above mentioned recent cognitive research program on test anxiety, domain-specific measurements of self-concepts of own competence and control orientations will be of special relevance.

Research results on the interdependency of test anxiety and domain-specific self-related cognitions can mostly be integrated into this theoretical frame of reference: test anxiety is correlated with low self-concepts of own competence and external control orientations (see, e.g., Hodapp, 1979; Jerusalem, 1984; Nicholls, 1979; Schwarzer, 1986; Van der Ploeg *et al.*, 1984). However, most studies use cross-sectional designs, which make it difficult to test directional causal hypotheses. Only Jerusalem (1984) and Hodapp (1979) analyzed longitudinally the causal relations between self-related cognitions and test anxiety in samples of German students. Jerusalem (1984) restricted himself to empirically testing the undirectional hypothesis that self-concept determines test anxiety; his data confirm this hypothesis for time intervals between 5 and 14 months. Hodapp (1979), who — however — observed only a time span of six weeks, tested the causal hypothesis bidirectionally with the help of cross-lagged correlation analyses and came to the same result. However some results and theoretical considerations allow the reverse causal relationship to be propagated, namely, test anxiety is the determinant of low self-concept and external control orientation (e.g., Jacobs and Strittmatter, 1979; see also the recent discussion between Bandura, 1986b; Kirsch, 1985, 1986; Wilkins, 1986). In addition there exists a third interpretation of the documented relations between (test) anxiety (or more generally: emotions) and self-related cognitions. This interpretation refers to the argument of a priori, conceptual interdependencies between emotions and cognitions (see, e.g., Brandtstädter, 1983; Smedslund, 1978) and, thus, their a priori confounding in conceptualization and

measurement. Following this interpretation one can hardly differentiate between causes and effects: test anxiety and self-related cognitions are assumed to be related in a complex, language-transmitted way, which does not allow undirectional interpretations. The question of the adequacy of these three competing interpretations of the interdependency between test anxiety and self-related cognitions is of theoretical relevance as well as of practical relevance (see, e.g., Bandura, 1986b; Kirsch, 1985, 1986; Wilkins, 1986).

The present study focuses on:

(1) Descriptive analyses of the development of domain-specific anxiety and self-related cognitions in secondary school students of grades six to ten (questions regarding the stability/plasticity and the developmental gradients of these variables).
(2) The null hypothesis that there are no causal relationships between test anxiety and domain-specific self-related cognitions (aspects of competence and control orientations) is tested quasi-experimentally; in case that the alternative hypothesis (there is indication of a causal relationship) must be accepted, we will test the causal relationship bidirectionally over the course of time.
(3) Measures of generalized anxiety and locus of control are additionally included in the study, to test the hypothesis of relevance of domain-specific measurements in analyses of test anxiety.

METHOD

Sample

The analyses reported below are based on questionnaire data obtained from 346 secondary school students (grades six to ten) at two times of measurement (interval of ten months). The sample consists of 170 girls and 176 boys with a mean age of $M = 13.4$ years ($SD = 1.36$). In spite of a relatively high dropout rate at the second time of measurement (10.1 precent), which can be attributed to the fact that most students who had finished school could not be reached again, no significant dropout effects were observed on any of the variables considered with reference to the data of the first measurement, $t(344) \leq 1.44$.

Variables

The students answered the following questionnaires two times:

(1) *Anxiety Questionnaire for Students* (AFS; Wieczerkowski *et al.*, 1975) measuring test anxiety (PA), manifest anxiety (MA), negative attitude to school (SU) and social desirability (SE).
(2) The *domain-specific IPC Scales* (Krampen, 1984), a 24-item questionnaire constructed in accordance with Levenson's (1974) distinction between internality (I), powerful others control (P) and chance control (C) measuring these three aspects of locus of control orientations for problem-solving behavior in academic settings.
(3) A short, 3-item questionnaire for the measurement of the *self-concept of own mathematical competence* (SKM) measuring self-ratings of own competence by social, intraindividual and criterion-oriented comparisons of own mathematical achievements. The SKM includes self-ratings from bipolar 6-point scales for the

following items: (a) In comparison to other students my math achievements are high above *versus* below average; (b) In comparison to my former math achievements and grades, I have recently improved a lot *versus* I have gotten worse; (c) I understand the subject matter of math lessons very good *versus* very badly.

(4) *LOC-K Scale* (Rinke & Schneewind, 1978), a German version of the "Children Nowicki-Strickland I-E Scale" (Nowicki and Strickland, 1973) measuring highly generalized control orientations on the bipolar dimension of external versus internal locus of control.

Checks of split-half reliability and internal consistency confirm the usefulness of all questionnaires in the present sample for group analyses. The coefficients of internal consistency of all scales at the first and second time of measurement are listed in Table 1. All data were gathered anonymously; questionnaires were assigned to persons by using a stable code.

RESULTS

Different methods of analysis of variance and correlation analysis are used in the following. Given the number of statistical tests applied to the data, we controlled for chance findings within each family of analysis by using either overall tests with a posteriori comparisons or binomial tables to determine the number of significant findings likely to arise by chance given the number of statistical tests/coefficients tested (see Feild & Armenakis, 1974). For all analyses presented below the *number* of significant results obtained *within* each analysis can only be attributed to chance with a probability of $p < .001$. The significance level for each analysis was fixed at a minimum of $p < .05$.

Cross-sequential findings

In the following cross-sequential findings for test anxiety and the self-related cognitions are described, which were analyzed by nonorthogonal analyses of variance (ANOVA) involving the factors Grade Level (G) and Time of Measurement (T) with repeated measurement on the second factor. While no interaction effect of these factors reaches statistical significance, $F(4, 341) \leq 2.31$, almost all main effects turn out to be significant beyond alpha = .05. Effect sizes (in terms of the percentage of variance explained by a main effect) reach medium to large values. Of special interest is the high consistence of cross-sectional (factor G) and longitudinal (factor T) findings. Figures 1 to 5 illustrate these cross-sequential results. The scores of the dependent variables have been transformed to *T-scores* to assure the visual comparison of the presented developmental gradients.

For test anxiety (see figure 1) the main effects for Grade Level, $F(4,341) = 2.99$, $p < .01$ (explained variance: 18.1%), and Time of Measurement, $F(1,341) = 3.90$, $p < .05$ (explained variance: 8.7%), consistently confirm the cross-sectional findings of Schwarzer (1975) of a decrease with grade level/age in German secondary school students. Longitudinally there is—similar to the findings of Jerusalem (1984)—a weak increase in the test anxiety in grade six, but which could not be assured in a posteriori tests. A similar (weak) increase in test anxiety is observed longitudinally as well as cross-sectionally for grade nine, which reaches significance in the Duncan Test ($p < .05$). Thus, before starting the last school year there seems to be a weak increase in

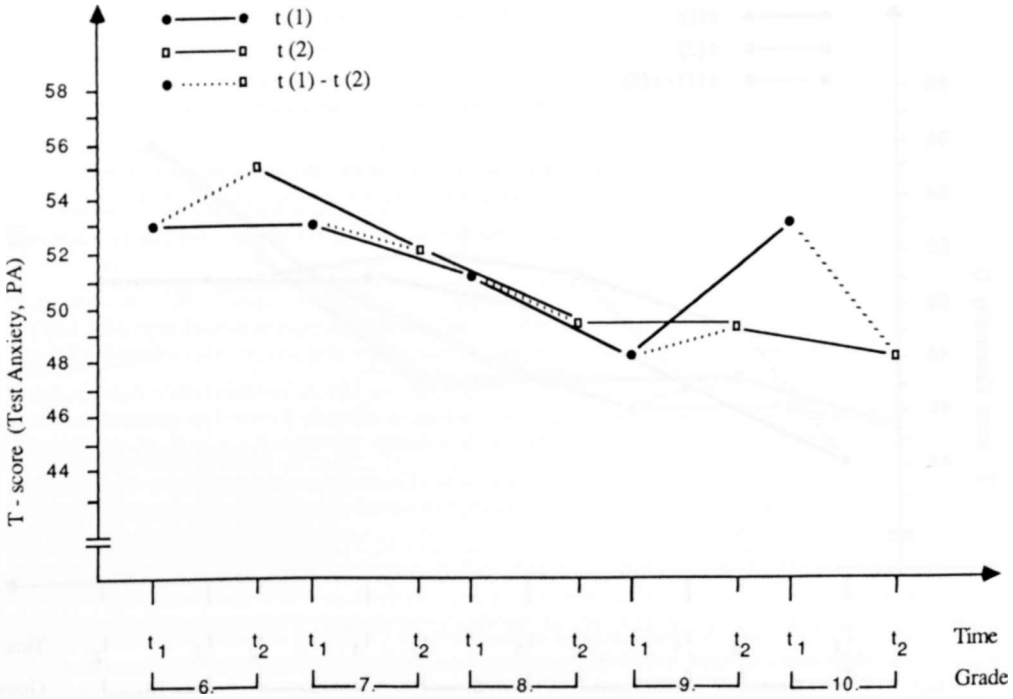

Figure 1 Cross-sequential Findings for Test Anxiety.

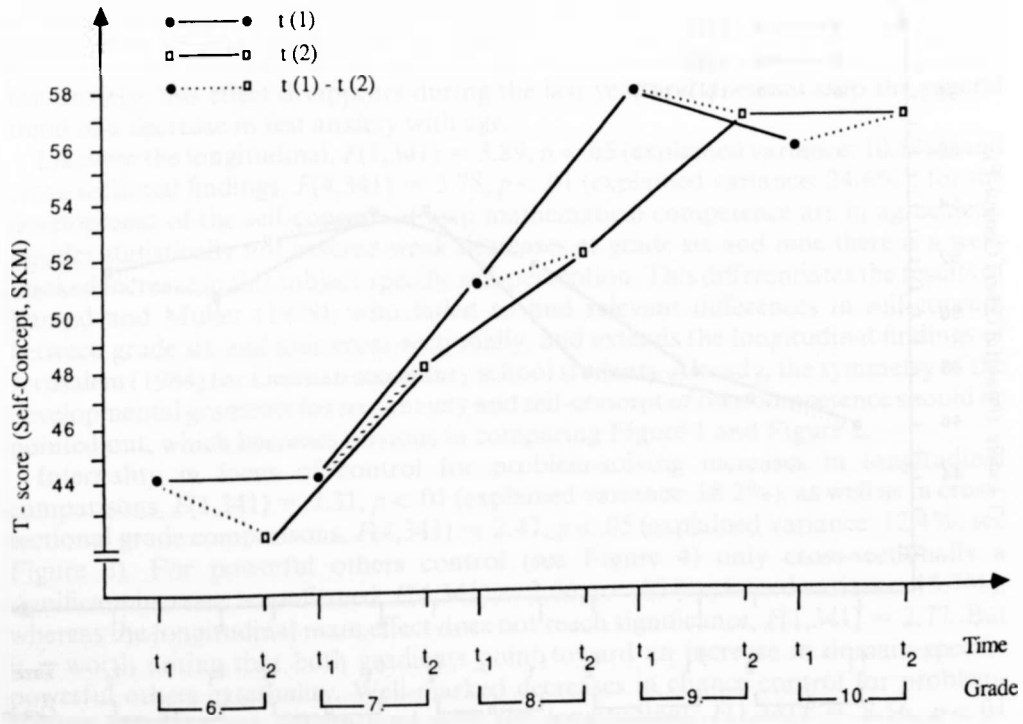

Figure 2 Cross-sequential Findings for the Self-Concept of own Mathematical Competence.

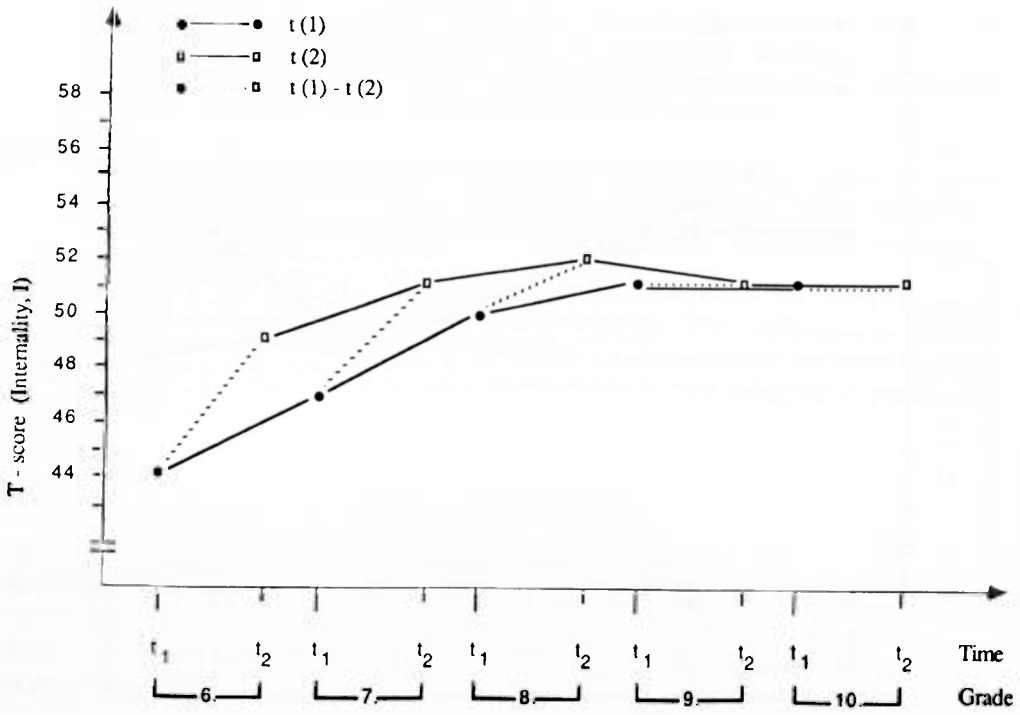

Figure 3 Cross-sequential Findings for Internality in Locus of Control for Problem-solving.

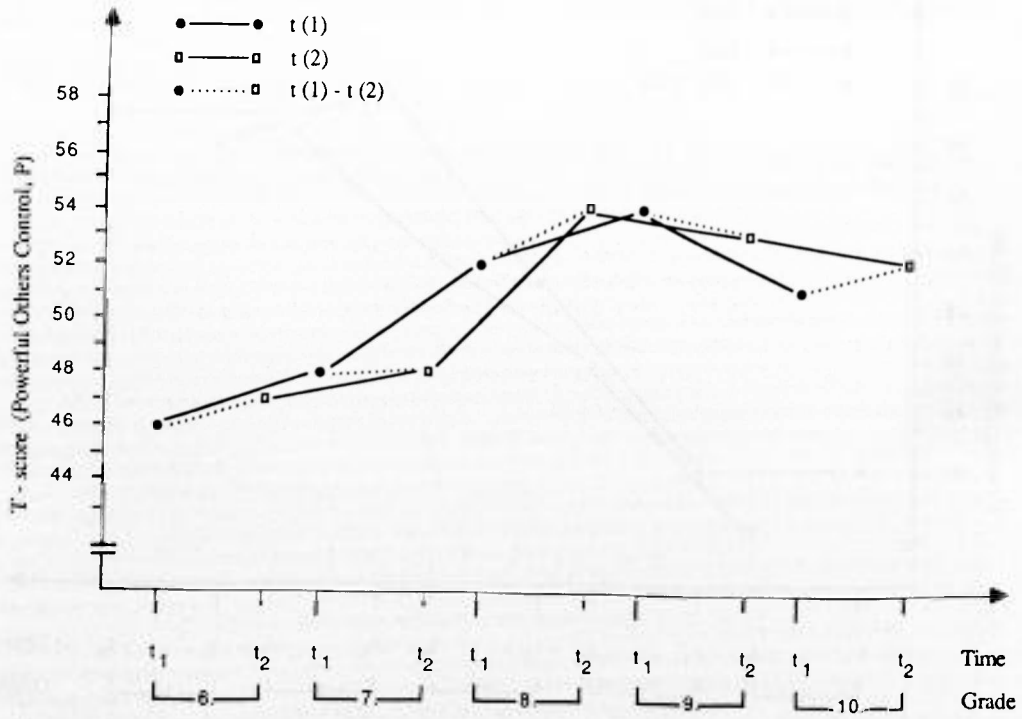

Figure 4 Cross-sequential Findings for Powerful Others Control in Locus of Control for Problem-solving.

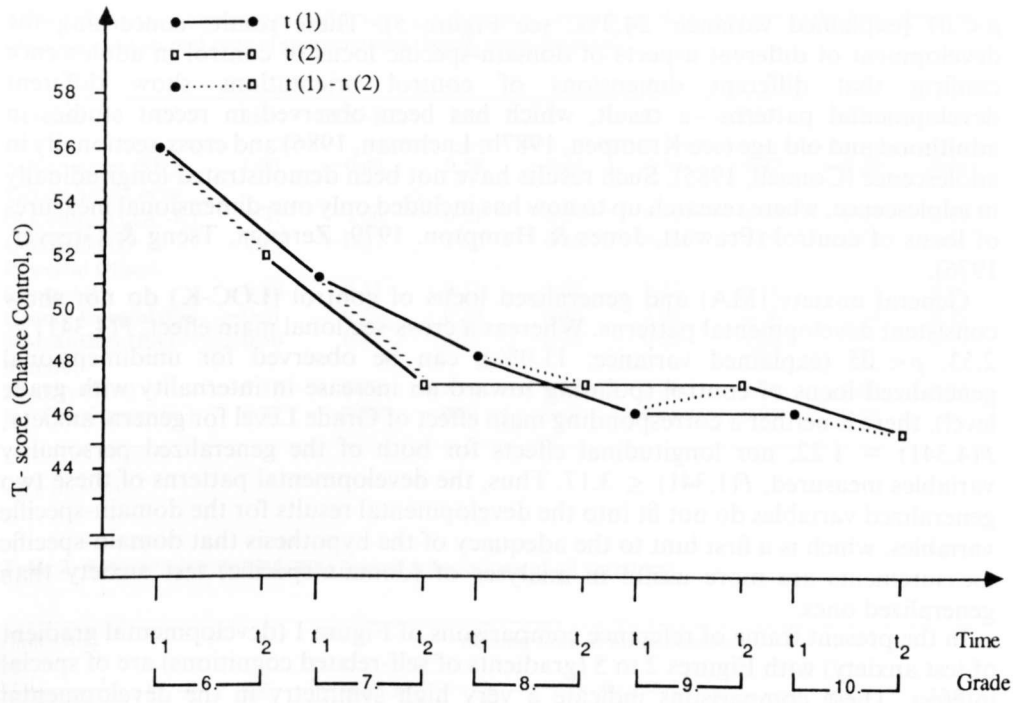

Figure 5 Cross-sequential Findings for Chance Control in Locus of Control for Problem-solving.

test anxiety; this effect disappears during the last year and does not stop the general trend of a decrease in test anxiety with age.

Likewise the longitudinal, $F(1,341) = 3.89, p < .05$ (explained variance: 10.5%), and cross-sectional findings, $F(4,341) = 3.78, p < .01$ (explained variance: 24.6%), for the development of the self-concept of own mathematical competence are in agreement. Besides statistically not assured weak decreases at grade six and nine there is a well-marked increase in this subject-specific self-perception. This differentiates the results of Larned and Muller (1979), who failed to find relevant differences in self-concept between grade six and nine cross-sectionally, and extends the longitudinal findings of Jerusalem (1984) for German secondary school students. Already, the symmetry of the developmental gradients for test anxiety and self-concept of own competence should be pointed out, which becomes obvious in comparing Figure 1 and Figure 2.

Internality in locus of control for problem-solving increases in longitudinal comparisons, $F(1,341) = 7.31, p < .01$ (explained variance: 18.2%), as well as in cross-sectional grade comparisons, $F(4,341) = 2.47, p < .05$ (explained variance: 12.4%; see Figure 3). For powerful others control (see Figure 4) only cross-sectionally a significant increase is confirmed, $F(4,341) = 2.66, p < .05$ (explained variance: 15.7%), whereas the longitudinal main effect does not reach significance, $F(1,341) = 2.77$. But it is worth noting that both gradients point toward an increase in domain-specific powerful others externality. Well-marked decreases in chance control for problem-solving behavior are documented with the longitudinal, $F(1,341) = 8.56, p < .01$ (explained variance: 19.0%), as well as with the cross-sectional data, $F(4,341) = 4.01,$

$p < .01$ (explained variance: 24.3%; see Figure 5). These results concerning the development of different aspects of domain-specific locus of control in adolescence confirm that different dimensions of control orientations show different developmental patterns—a result, which has been observed in recent studies in adulthood and old age (see Krampen, 1987b; Lachman, 1986) and cross-sectionally in adolescence (Connell, 1985). Such results have not been demonstrated longitudinally in adolescence, where research up to now has included only one-dimensional measures of locus of control (Prawatt, Jones & Hampton, 1979; Zerenga, Tseng & Greever, 1976).

General anxiety (MA) and generalized locus of control (LOC-K) do not show consistent developmental patterns. Whereas a cross-sectional main effect, $F(4,341) = 2.53$, $p < .05$ (explained variance: 11.0%), can be observed for unidimensional generalized locus of control (pointing toward an increase in internality with grade level), there is neither a corresponding main effect of Grade Level for general anxiety, $F(4,341) = 1.22$, nor longitudinal effects for both of the generalized personality variables measured, $F(1,341) \leq 3.17$. Thus, the developmental patterns of these two generalized variables do not fit into the developmental results for the domain-specific variables, which is a first hint to the adequacy of the hypothesis that domain-specific measurements are more useful in analyses of (domain-specific) test anxiety than generalized ones.

In the present frame of reference comparisons of Figure 1 (developmental gradient of test anxiety) with Figures 2 to 5 (gradients of self-related cognitions) are of special interest. These comparisons indicate a very high symmetry in the developmental patterns of test anxiety on the one hand and of the four domain-specific, self-related cognitions on the other. This symmetry includes even the statistically only partially confirmed developmental specifics at grade levels six and nine. But symmetries in developmental gradients point only toward covariations of the variables under consideration, not yet toward causal relationships between them. The results of corresponding analyses will be reported in the following.

Self-Related Cognition and Test Anxiety

The intercorrelations of all measured variables are presented in Table 1 separately for the first and second time of measurement. These synchronous correlations essentially confirm results of cross-sectional studies: generalized externality in locus of control is correlated with test and general anxiety, a low self-concept is correlated with test anxiety, general anxiety is correlated with test anxiety, etc. (see, e.g., Jopt, 1978; Krohne *et al.*, 1986; Wieczerkowski *et al.*, 1975). Noteworthy is only the remarkably high stability of these correlative relations: the coefficients of the second time of measurement rarely differ from those at the first time of measurement.

The autocorrelations of all variables (see the main diagonal in Table 2) show a medium developmental stability. In particular, they illustrate the plasticity of test anxiety and domain-specific self-related cognitions in adolescence and point out the need of (longitudinal) studies that search for the developmental determinants of such age-related changes. However, autocorrelations of the variables are only somewhat lower than their reliabilities (see Table 1). This impedes unequivocal interpretations of their developmental plasticity.

Table 2 also includes the cross-lagged correlations of all variables, whose numerical values drop markedly in comparison with the synchronous correlations. The relationships between all variables were analyzed bidirectionally by the *quasi-experimental* technique of cross-lagged correlation analysis (see, e.g., Kenny, 1979),

Table 1. Internal consistency as well as time-synchronous correlations of all variables at the first (above main diagonal) and second time of measurement (below main diagonal)[a]

Variable	SK	LOC-K	I	P	C	PA	MA	r_{tt}
Self-Concept (SK)	1·00	−0·43	0·58	−0·42	−0·59	−0·47	−0·39	0·81
Generalized Locus of Control (LOC-K)	−0·47	1·00	−0·21	0·27	0·24	0·35	0·45	0·59
Internality (I)	0·61	−0·27	1·00	−0·35	−0·23	−0·23	−0·13	0·64
Powerful Others Control (P)	−0·40	0·31	−0·31	1·00	0·57	0·38	0·35	0·67
Chance Control (C)	−0·51	0·27	−0·20	0·48	1·00	0·30	0·34	0·59
Test Anxiety (PA)	−0·50	0·41	−0·27	0·36	0·29	1·00	0·71	0·79
Manifest Anxiety (MA)	−0·32	0·40	−0·11	0·43	0·40	0·71	1·00	0·77
Int. Consistency (r_{tt})	0·77	0·58	0·71	0·69	0·65	0·77	0·75	—

[a] $r \geq |0{\cdot}11|$, $p < 0{\cdot}05$.

Table 2. Autocorrelations and cross-lagged correlations of all variables[a]

First time of measurement	Second time of measurement						
	SK	LOC-K	I	P	C	PA	MA
Self-Concept (SK)	0·69	−0·29	0·39	−0·37	−0·43	−0·27	−0·17
Generalized Locus of Control (LOC-K)	−0·32	0·44	0·18	−0·22	−0·12	0·11	0·19
Internality (I)	0·53	0·16	0·59	−0·22	−0·17	−0·24	−0·13
Powerful Others Control (P)	−0·32	−0·25	−0·13	0·64	0·35	0·08	0·07
Chance Control (C)	−0·41	−0·17	−0·14	0·30	0·58	0·23	0·12
Test Anxiety (PA)	−0·12	0·08	−0·08	0·04	0·07	0·71	0·64
General Anxiety (MA)	−0·15	0·13	−0·08	0·06	0·14	0·61	0·74

[a] Interval of ten months; $r \geq |0{\cdot}11|$, $p < 0{\cdot}05$.

which gives at least some clues for possible causal relations. The null hypothesis that there are no causal relations between variable pairs can be rejected with reference to a significant z-value in the Pearson-Filon test for the following pairs of variables:

(1) A low self-concept of own mathematical competence precedes (high) test anxiety ($z = 3.002$, $p < .01$). Figure 6 illustrates this finding exemplarily for the results presented in the following.
(2) Low internality in locus of control for problem-solving precedes (high) test anxiety ($z = 2.833$, $p < .01$).
(3) High chance control in locus of control for problem-solving precedes (high) test anxiety ($z = 2.836$, $p < .01$).
(4) High internality in locus of control for problem-solving precedes a high self-concept of own mathematical competence ($z = 2.913$, $p < .01$).

Differences between all the other cross-lagged correlations (see Table 2) are not significant in the Pearson-Filon test, $z \leq 1.557$. Therefore, the null hypothesis that there are no causal relations between these variable pairs and that other variables must

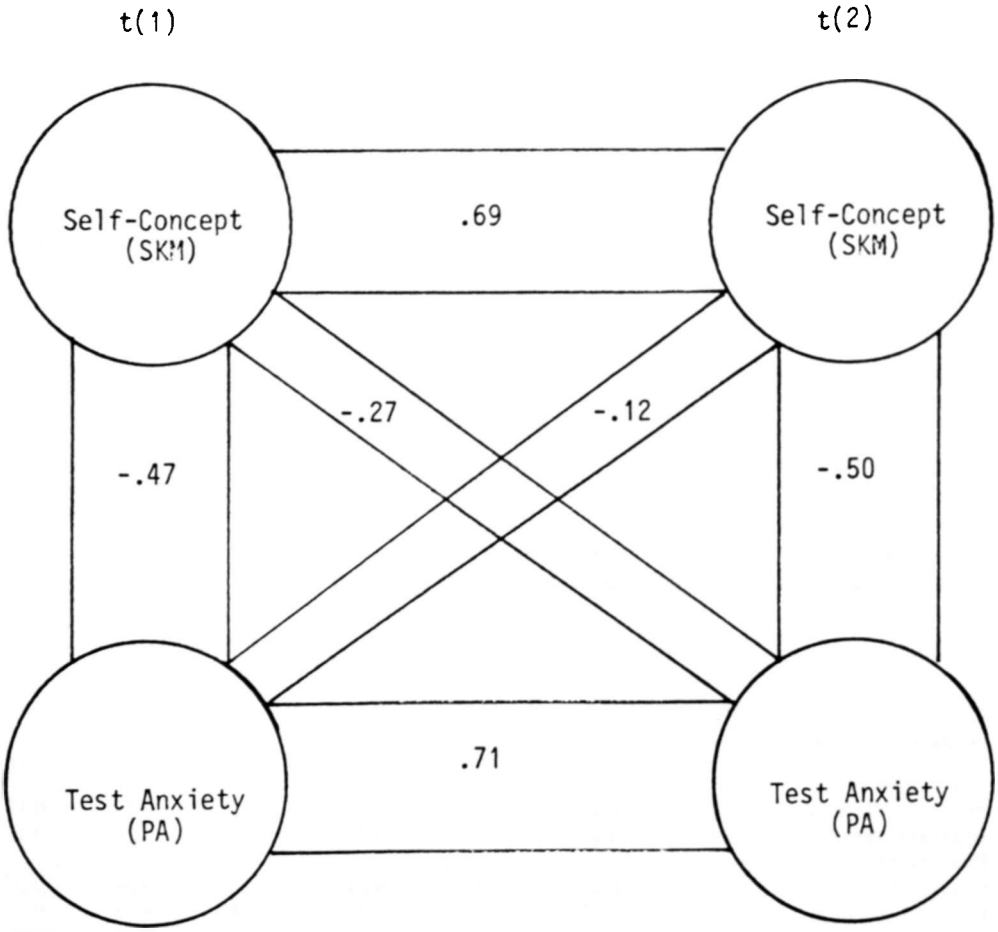

Figure 6 Cross-lagged Correlations for "Self-Concept of own competence" and "Test Anxiety" (Time Interval: Ten Months).

be responsible for their variability must be accepted. Thus, exclusively the domain-specific self-related cognitions (self-concept of own competence, internality and chance control) are quasi-experimentally confirmed to be antecedents of test anxiety. But it is worth noting that these quasi-experimental results may only be interpreted as hints for causal relations, which need experimental confirmation. To complete the picture, the probability of obtaining the presented number of significant differences (Pearson-Filon test) by chance in this group of cross-lagged analyses is $p < .001$.

Finally time-synchronous and cross-lagged multiple regression analyses were computed (1) to evaluate the relative prognostic value of the domain-specific self-related cognitions for test anxiety and (2) to compare the quantitative and qualitative stability of time-synchronous and cross-lagged results in a multivariate analysis. The results (see Table 3) show that the multiple correlations reach significance in all three analyses, but that cross-lagged prediction distinctly explains less variance of test anxiety than the two time-synchronous "predictions" (which are—of course—no predictions in the real sense of the word). Besides this quantitative difference there is also a qualitative one: structure coefficients of the cross-lagged multiple correlation point toward the (relative) high prognostic value of (low) self-concept, (low) internality

Table 3. Time-synchronous and cross-lagged multiple regression of domain-specific self-related cognitions for test anxiety[a]

Predictor Variable	First measurement (t_1)		Second measurement (t_2)		Cross-lagged (t_1-t_2)	
	r_c	st.	r_c	st.	r_c	st.
Self-Concept	−0·47	−0·89	−0·50	−0·94	−0·27	−0·82
Internality	−0·23	−0·44	−0·27	−0·51	−0·24	−0·73
Powerful Others Control	0·38	0·72	0·36	0·67	0·08	0·24
Chance Control	0·30	0·57	0·29	0·54	0·23	0·70
Multiple Correlation (R)	0·53*		0·53*		0·33*	
Multiple Determination (R^2)	0·28		0·28		0·11	
Rho	0·52		0·53		0·31	

*$p < 0{\cdot}01$.
[a] r_c = predictor-criterion correlation; st. = structure coefficients; $r_c \geq 0{\cdot}11$, $p < 0{\cdot}05$.

and (high) chance control; in contrast to these cross-lagged findings, chance control plays a minor role in the time-synchronous analyses. Instead, powerful others control, whose predictive value in the cross-lagged analysis is lowest, is the second best "predictor" of test anxiety in the two time-synchronous analyses (see Table 3).

DISCUSSION

By means of cross-sequential data the relevance of domain-specific self-related cognitions for the development of test anxiety in German secondary school students has been confirmed empirically. Already the inspection of the developmental gradients, which are in accordance with other results (see, e.g., Jerusalem, 1984; Krampen, 1987b), leads to the cross-sectionally as well as longitudinally confirmed impression of strong interdependencies between test anxiety on the one hand and self-concept of own competence, internality, powerful others control and chance control in domain-specific self-related cognitions on the other. The results of cross-lagged correlation analyses (involving a time interval of ten months) confirm this impression inference-statistically. Most findings support the hypothesis of social cognitive theories that self-related cognitions precede test anxiety and are causal for its development (e.g. Bandura, 1986a, 1986b; Schwarzer, 1986). Of course, the quasi-experimental design of the present study must be considered. The results only intimate possible unidirectional causations, which must be confirmed with experimental data.

At the same time comparisons between the results of time-synchronous (cross-sectional) and cross-lagged (longitudinal) analyses suggest that cross-sectional data tend to overestimate developmental relations quantitatively. The relationship between self-related cognitions and anxiety is better represented by current cognitions than by past cognitions. The demand for longitudinal studies within a developmental and etiological perspective is accentuated by the finding of a qualitative difference between cross-sectional and longitudinal results: whereas powerful others control orientations of students have a very high prognostic value for test anxiety in the time-synchronous analyses, they turned out to be of lowest importance in the cross-lagged, longitudinal predictions. Instead, fatalistic (chance) control orientations have a relatively high prognostic value for test anxiety.

In the present study the heuristic value of a hierarchical model of personality could

be confirmed again (see Krampen, 1987a, 1988). The action-theoretical model of personality distinguishes between different levels of generalization in personality description and relates them by the transmission of the subjective perception of an action or life situation to statements about the optimal level of measurement. Consistent with our hypothesis, general anxiety and generalized locus of control play minor parts in the development of test anxiety in students. If one is interested in domain-specific variable (like test anxiety in school), it is best to apply domain-specific measurements of all variables (see also Bandura, 1986a). This is especially true when action or life situations are under consideration, which are more or less new and/or ambiguous for the individual.

Future research should consider additional aspects of domain specificity (like subject-matter related cognitions and anxieties; see, e.g., Lukesch, 1982) and construct differentiation (like worry and emotionality; see, e.g., Jerusalem, 1984; Lukesch & Kandlbinder, 1986; Schwarzer, 1986) which have been neglected in the present study. The same is true for situational, environmental and contextual determinants of test anxiety in students. The recent propagation of social cognitive approaches in anxiety research (and — in part — that of psychophysiological approaches) and the resulting concentration on person variables should not result in the neglect of such structural and contextual variables which have proved to be highly relevant correlates and determinants of test anxiety (see, e.g., Schwarzer, 1975, 1981). Besides methods which focus on the self-related cognitions of students and which are confirmed as essential by the presented results (see also Bandura, 1986a, 1986b), psychological prevention and modification of test anxiety must apply techniques which focus on the modification of achievement situations in school (e.g., optimizing their transparency and clearness; see, e.g., Gifford & Marston, 1966) and must consider the social and contextual determinants of test anxiety as well (see already Schreiber, 1899).

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