Andreas Krapp, Ulrich Schiefele, Adolf Winteler

Interest as a predictor of academic achievement : a meta-analysis of research

first published in:
The role of interest in learning and development / K. A. Renninger, S. Hidi & A. Krapp (Eds.). - Hillsdale, NJ : Erlbaum, 1992. - S. 183-196

8 Interest as a Predictor of Academic Achievement: A Meta-Analysis of Research

Ulrich Schiefele, Andreas Krapp, and Adolf Winteler
Universität der Bundeswehr – Munich

The explanation and prediction of academic achievement is an important area of research in educational psychology. The prevalence of research efforts in this area reflects the fact that many decisions reached in the modern educational system are based upon predictions of school success. Such decisions include choosing the optimal time for entering school, selecting the appropriate type of school or academic track, being accepted at a certain college or university, or the choice of a particular field of study. Because these decisions can greatly influence the life of a young person, a period of careful consideration often precedes the final decision. Parents and students often seek counseling. Institutions such as schools and colleges have developed special entrance tests, and base their recommendations or decisions upon systematic diagnostic data. The estimation of a candidate's probability of future academic success is a central aspect of the decision-making process, regardless of whether the process involves personal decisions or institutional decisions (Cronbach & Gleser, 1965; Jungermann, 1976; Krapp, 1979; Lee, 1971).

Generally, every prognosis relevant to educational or academic goals is based upon two types of data: (a) data pertaining to the requirements and conditions of the desired educational path (e.g., curricular goals, level of difficulty, qualification of instructors), and (b) data pertaining to the prospective student (e.g., cognitive abilities, motivational orientation). To the extent that a decision has long-term implications (i.e., when the final evaluation of a course of schooling lies far ahead in the future), the diagnosis of *enduring characteristics* of student performance prevails.

In view of the great practical importance of academic career decisions, it is not surprising that for decades scientists have invested a considerable amount of time to find highly predictive and stable determinants of academic achievement. Reviews with varying emphases and inclusiveness have been written, for example, by Bloom (1976), Fleming and Malone (1983), Lavin (1965), Sauer and Gattringer (1985), Steinkamp and Maehr (1983), and Tiedemann (1977). Occasionally, attempts have been made to summarize the various findings and to organize the great number of predictive variables into theoretically meaningful classes (e.g., Haertel, Walberg, & Weinstein, 1983; Krapp, 1984; Kühn, 1983).

Three major groups of factors that influence achievement are distinguished: student characteristics (e.g., intelligence), home environment (e.g., socioeconomic class), and school context (e.g., quality of instruction). Academic career decisions, as described before, rely primarily on student characteristics that are classified in a variety of different ways. Regardless of the theoretical foundations and the particular goals of different approaches, one usually finds three broad classes of factors that are considered to be especially relevant to a successful prognosis of academic success: (a) general cognitive factors (e.g., verbal ability), (b) general motivational factors (e.g., achievement motivation), and (c) specific preferences for particular subject areas. The latter group is commonly referred to as "interests."

Cognitive factors have been found to exhibit the greatest predictive power. In empirical studies they account for the largest part of observed achievement variance (e.g., Bloom, 1976; Kuusinen & Leskinen, 1988). There is general agreement, based on empirical evidence, that motivational or emotional factors are of less importance. A number of reviews (e.g., Kühn, 1983; Steinkamp & Maehr, 1983) and recent studies using causal modeling procedures (e.g., Parkerson, Lomax, Schiller, & Walberg, 1984; Quack, 1979; Schneider and Bös, 1985) confirm the importance of cognitive factors. As predictors, they usually explain up to 50% of the variance in achievement, calculated on the basis of correlation and regression analyses (e.g., Khan, 1969; Lavin, 1965; Nichols, 1966; Steinkamp & Maehr, 1983). However, more precise analyses of variance yield a more differentiated picture.

According to Quack (1979), considering both cognitive and noncognitive factors simultaneously, and calculating specific and confounded portions of explained variance for both groups, reveals that approximately 25% to 30% of the observable variance in academic achievement can be explained on the basis of cognitive factors alone. A further 25% portion of the observable variance is explained by noncognitive factors. According to Quack, there are two "threshold values" for the portions of variance explained by cognitive factors. The first threshold corresponds to the "pure" portion of explained variance (25% to 30%). The second threshold denotes a "ceiling value" of about 50% for the portion of explained variance that is confounded with noncognitive variables.

Schneider and Bös (1985), who used data from fourth-graders and causal modeling procedures, came to similar conclusions. Their analysis confirms that researchers have tended to underestimate the influence of noncognitive factors on academic achievement. These include motivational factors, which often influence achievement indirectly.

This chapter provides an overview of previous research results pertaining to the relation between interest and academic achievement. First, we focus on the conceptualization and operationalization of interest. Then the goals and procedures adopted by most studies on the interest–achievement relation are discussed. Results from this branch of research are reviewed in the next two sections. Whereas studies published prior to 1965 are summarized on the basis of earlier reviews, a meta-analysis is applied to studies published after 1965. The major goals of the meta-analysis were to determine the strength of the predictive value of interest and to identify variables that moderate the impact of interest on achievement. Finally, the results of the review are discussed and suggestions for future research are given.

CONCEPT AND MEASUREMENT OF INTEREST

Predictions of academic success or failure are based upon information about cognitive and noncognitive prerequisites for learning that generally correlate with academic achievement and, hence, serve to explain the variability of academic performance. With this goal in mind, the search for likely predictors of academic achievement centers around behavioral characteristics of the student that can be shown to exert a significant effect in many learning situations and in a stable manner over time. Only those factors that exhibit a general and stable influence can contribute consistently to predictions of school performance.

The goal of finding general, stable predictors of achievement has also affected studies that have included measures of interest as predictors. Many of these studies rely almost exclusively on dispositional conceptions of interest. Borrowing from theoretical models and diagnostic measures developed in vocational psychology (Allehoff, 1985; Barak, 1981; Holland, 1973, 1976; Walsh & Osipow 1986), research in this area is based on a concept of interest that has been shaped by the principles of traditional personality psychology. From this theoretical perspective, interests are conceived of as traits or dispositions. Todt (1978), for example, refers to them as "...behavioral or action tendencies that are relatively long-term and relatively generalized [and] ... that are aimed at various domains of objects, activities, or experiences" (p. 14). As a consequence, interests are usually measured with standardized tests developed in vocational psychology. Typical tests are the Strong Vocational Interest Blank, the Kuder Preference Record, or the Vocational Preference Inventory (see Walsh & Osipow, 1986). In addition, numerous questionnaires have been developed to predict achievement in particular schools, age groups, or subject areas (e.g., Carter, 1982; Harty & Beall, 1984; Hoffmann & Lehrke, 1986).

STRATEGIES AND METHODS OF RESEARCH

The analysis of the predictive power of interest has usually involved examining whether a systematic relation exists between interest and a certain achievement criterion (e.g., grade points). This has almost always taken the form of simple correlation and regression analyses. Most studies have neglected the problems of prognostic stability and causal directionality. Instead, the conclusions drawn have been largely limited to whether a portion of the observed variance in achievement could be attributed to interest with sufficient probability. Very few studies have included a test of whether and to what extent the interest measured at Time 1 actually predicted academic achievement at Time 2. Only in this case could interest truly be regarded as a causal antecedent of achievement. In addition, no study was found that tested the prognostic stability of interest by varying the time lag between measuring interest and achievement.

Almost all empirical studies have attempted to quantify the relation between interest and academic achievement by means of a more or less controlled explanation of variance. Many studies have calculated correlations without systematically controlling for alternative influence factors. By contrast, methodically more sophisticated studies have controlled for the influence of alternative predictors either by ensuring that these predictors were equally prevalent in a group of subjects or by employing statistical procedures (e.g., analysis of covariance) to eliminate the influence of these factors.

Another problem of prediction research is related to the influence of moderator variables, such as gender or age (Saunders, 1956; Zedeck, 1971). Rather different results may be obtained for the same set of predictors, depending on the number or type of included moderator variables. Often, these variables cannot independently contribute to the prediction of a criterion. They can be highly effective, however, in differentiating samples into subgroups with varying degrees of predictability (Jäger, 1978; Rosemann & Allhoff, 1982).

RESEARCH CONDUCTED PRIOR TO 1965: A SUMMARY OF REVIEWS

Although early research on noncognitive factors in academic achievement often included interest as a predictor, later research neglected this variable. Similarly, research summaries written prior to 1970 regularly include references to the effect of interests, whereas more recent review articles (e.g., Fleming & Malone, 1983; Steinkamp & Maehr, 1983; Uguroglu & Walberg, 1979; Willson, 1983) contain no mention of interest. Super (1960) summarized a series of studies published in the United States before 1957. The empirical correlations between interest scores (usually measured by vocational interest tests) and indicators of academic achievement at both the school and the college levels rarely exceeded .30. Higher correlations emerged for samples that exhibited either homogeneity in terms of ability or at least moderate variability in level of interest. Conditions characteristic of the school or college environment were also found to be of importance. For example, the prevalence of a competitive atmosphere seemed to reduce or obstruct the interest effect.

Fishman and Pasanella (1960) reviewed a total of 580 studies published between 1949 and 1959 on the relation between cognitive and noncognitive predictors and average college grades. Seven studies investigated the interest–achievement relation and yielded correlations between .05 and .26.

Lavin (1965), who relied primarily on material different from that used by Super, reached similar conclusions. In both college and high school, the correlations between interest and grades did not exceed .30. Lavin explained this by noting that, at least in the case of college students who had already selected a particular major, the level of interest in the subject matter was uniformly high. Thus, only a small degree of variance in measures of interest was found. Interest was, however, highly correlated (up to .70) with indicators of performance in specific courses. Lavin pointed out that almost none of the studies he reviewed distinguished between male and female subjects, and only some of the studies controlled for the students' ability levels. In those studies that did control for ability, however, significant correlations between interest and achievement were consistently found.

Trost (1975) described a number of other studies of the relation between interest and academic achievement that were published before 1965 (and not included in the work of either Super or Lavin). He distinguished between studies that attempted to predict overall success (final exam results or grade point average) and those that concentrated on predicting success in particular subject areas or even particular courses. Although he found somewhat higher correlations between interest and success in particular courses, he concluded that correlations between interest and achievement generally tended to be relatively small.

The findings just reported suggest that interest is moderately useful as a predictor of academic achievement. However, restrictions in the variance of interest scores, heterogeneity of ability, and the use of unspecific achievement criteria often masked the interest effect.

RESEARCH CONDUCTED SINCE 1965: A META-ANALYSIS

Goals and Selection Procedures

This chapter overviews the past 25 years of research on the interest–achievement relation and suggests guidelines for future research in this area. The main questions are the following: How large is the correlation between interest and achievement in general? Can differences be found among the various subject areas? Does the influence exerted by interest become stronger or weaker during the school years? What part does gender play in the relation between interest and achievement?

One of the greatest difficulties of summarizing interest-related research is the extremely eclectic use of the interest concept. The term *interest* is often used interchangeably with terms such as *intrinsic motivation, subject-related affect, attitude, and cognitive motivation.* As a result, some studies purportedly having to do with interest have, in fact, measured something quite different. Conversely, some studies that actually addressed interest have, for instance, labeled it attitude, liking, or curiosity. This confusion leads to problems when attempting to identify relevant studies to analyze.

The present review is limited to studies that were concerned with the relation between individual interests explicitly directed towards specific subject areas (e.g., physics) and achievement in school. Our understanding of interest follows the conceptualization of H. Schiefele and colleagues (e.g., H. Schiefele, Krapp, Prenzel, Heiland, & Kasten, 1983) who, in accordance with older theories (Dewey, 1913; Kerschensteiner, 1922), discussed interest as a domain- or content-specific motivational characteristic (see chapters by Schiefele and Krapp & Fink, this volume).

For the purposes of this review interest was operationalized as involving some kind of preference for a school subject or for activities related to that subject. Studies that did not measure interest in a specific subject area were not included in the meta-analysis. Typical examples are the studies of Khan (1969) and Lloyd and Barenblatt (1984). In investigating the predictor "academic interest," Khan (1969) determined attitudes towards school work and instructional methods in general rather than towards a particular school subject. Similarly, Lloyd & Barenblatt (1984) used the construct "intrinsic intellectual motivation," which was meant to signify a person's habitual emotional reactions to the content and process of academic learning. Content referred to any possible material covered in school. Aside from the questionable meaningfulness, in purely psychological terms, of a concept of learning motivation not related to any particular subject area, these constructs failed to fulfill the criterion of domain specificity crucial both to earlier as well as in present conceptualizations of interest.

Evaluation of achievement criteria presented less of a problem. Most of the studies relied on standardized knowledge tests, grades, or grade averages to measure achievement. Studies that involved relatively specific criteria for determining performance (e.g., solving of certain problems, memorizing of a text) were excluded from consideration. Overviews of studies addressing the relation between narrowly defined interests and specific performance criteria have been provided by Hidi (1990; see also Hidi & Baird, 1986), Schiefele (1988, this volume), and Wade (this volume).

The search for relevant studies was conducted using the databases PSYCINFO (Anglo–American literature) and PSYNDEX (German literature). In addition, periodicals were scanned; however, no unpublished dissertations were included.[1] A great variety of key words was used in the search, because relevant studies were often found hiding behind seemingly irrelevant titles. Key words included interest, academic achievement, motivation, attitude, and affect.

Sixteen publications were identified that fit the criteria they were focused on: the relation between interest and achievement. They contain 121 independent random samples (or independent single studies, respectively) from 18 different countries. The sample groups ranged in size from 49 to 15,719. The grade levels ranged from the 5th to the 12th grade. Nine different subject matter areas were covered. Finally, these studies reported a total of 189 correlations between measures of interest and measures of achievement (see Table 8.1).

More than half of all of the correlations (108 out of 189) came from studies initiated by the International Association for the Evaluation of Educational Achievement (IEA, e.g., Husén, 1967). The IEA project was carried out in 21 countries and involved a total of six school subjects. Generally, two populations were studied: 13- or 14-year-old students, usually in the 8th grade, and 18-year-old students, usually in the 12th grade. Both populations were then broken down further.

Meta-Analytic Procedures

In order to achieve a more objective summary of the studies included in this review, meta-analytical methods were adopted (Fricke & Treinies, 1985; Glass, 1976; Glass, McGaw, & Smith, 1981; Hunter & Schmidt, 1990; Hunter, Schmidt, & Jackson, 1982; Kulik & Kulik, 1989). It seemed most appropriate to use guidelines developed by Hunter et al. (1982; Hunter & Schmidt, 1990) because these authors are especially concerned with the integration of results from correlational studies.

First, all relevant study features were coded. These included: size of correlation coefficients, sample size, gender of sample, year of publication, nationality of sample, type of achievement measure, reliability of both the interest and achievement measures, source of study (IEA vs. other), subject area, and grade level. Second, correlations were

---

[1] We are currently preparing an extension of the present analysis to include doctoral dissertations.

aggregated from different subgroups of studies (e.g., all studies involving mathematics as the subject area) and compared with each other. According to Hunter et al. (1982) the best estimate of the population correlation is given by the mean value of individual correlations weighted by the sample sizes of the corresponding studies. In addition, each correlation coefficient was converted into Fisher's z before using it for any computation.

Because a major goal of the present meta-analysis was an investigation of the effects of moderator variables (i.e., sex, subject area, grade level), it was necessary to determine whether the variance between correlations was solely due to sampling error or reflected a "real" variation between population values. If a large part of the observed variance could not be attributed to sampling error, then the correlations were seen as being heterogeneous and the existence of relevant moderator variables was very likely ("model of heterogeneous effects"). If the observed variance was caused mainly by sampling error, then the "model of homogeneous effects" could not be rejected and the search for moderator variables would be unwarranted.

Three different indicators of heterogeneity have been discussed in the literature (Schwarzer, 1989). First, Hunter et al. (1982) suggested that the percentage of observed variance accounted for by sampling error should be less than 75%. Second, the same authors (see also Hunter & Schmidt, 1990) proposed a Chi^2 test in which the observed variance for a group of correlations is related to the mean value of these correlations. Third, the population (or residual) standard deviation (i.e., square root of the difference between observed variance and sampling error variance) should be larger than one-fourth of the population correlation coefficient (McDaniel, Hirsh, Schmidt, Raju, & Hunter, 1986).

In some studies the same sample was used to generate several correlation coefficients. Such coefficients are dependent on each other and, therefore, were always combined into a single mean value and then entered into the calculation of the overall mean. In these cases the original sample size of a study was used as the weight. Thus, nonindependent results were not lumped together and the sample size was not inflated.

A major disadvantage of weighting correlation coefficients with sample size is that correlations based on very large samples become too influential. In the present case this concerns most samples from the IEA project (cf. Table 8.1). In order to control for the undue impact of these studies on the meta-analytic results, analyses of both weighted and

Table 8.1

Descriptive Information on Studies Included in the Review

Author	*Sample* *Grade*	*Size*	*Interest Measure (Item Content)*	*Achievement Measure*[a]	*Correlations*
			Mathematics		
IEA Study Husén; (1967)	8	Samples from 11 countries $n > 841$ $n < 6544$ m/f	Q: Desire for further education, liking the subject, quality of grades, career goals	IEA math achievement test (Rel.=.91)	.23 .24 .26 .27 .28 .29 .32 .35 .38 .39 .42
Wendeler; (1968)	10	227 117 (m) 110 (f)	Q: Self-rating of interest in various subject-related topics (Rel.=.96)	Grades	.38
Skager et al. (1965)	10/11	524 261 (m) 263 (f)	Q: Liking of various subject-related activities	Grades	m:.35 f:.31
Todt (1978)	10/11	220 120 (m) 100 (f)	T: Preference ratings for various subject-related activities (Rel.=.85)	Grades	m:.50 f:.47
Todt (1978)	10–12	158 96 (m) 62 (f)	T: see above	Grades	m:.53 f:.40
Todt (1978)	11/12	158 (f)	T: see above	Grades	.45
IEA Study Husén; (1967)	12	Samples from 9[b] countries $n > 369$ $n < 4372$ m/f	Q: see above	see above (Rel.=.86)	.16 .29 .29 .29 .30 .32 .33 .37 .39 .40 .43 .47 .51 .52
Todt (1967)	12	208 (m)	T: see above	Grades	.37
Sjöberg; (1983)	12	174 134 (m) 40 (f)	Q: Self-rating of general interest, personal significance, importance of success in subject area	Grades	.53
Sjöberg (1984)	12	100 71 (m) 29 (f)	Q: see Sjöberg (1983)	Grades	.44

			Science		
Harty & Beall; (1975)	5	95 m/f	Q: Liking for science-related activities (Rel.=.78c)	Grades	.30
IEA Study Comber & Keeves; (1973)	8	Samples from 15 countries $n > 697$ $n < 7363$ m/f	Q: Participation in science-related activities, enjoyment of science in school (Rel.=.74)	IEA science achievement test (Rel.=.83)	.09 .18 .23 .26 .26 .27 .32 .35 .35 .36 .37 .38 .39 .42 .49
IEA Study Kelly; (1978)	8	Samples from 7 countries $n > 932$ $n < 3823$ m/f	Q: General liking for science (Rel.=.76)	see Comber & Keeves (1973)	m: .22 .31 .37 .38 .41 .46 .52 f: .18 .23 .24 .25 .30 .34 .36
Napier & Riley; (1985)	11	3135 m/f	Q: 1) Liking for science classes (Rel.=.82), 2) Participation in science-related activities (Rel.=.83)	Science achievement test (Rel.=.82)	.18 .26
IEA Study Combe & Keeves (1973)	12	Samples from 14 countries $n > 491$ $n < 15719$ m/f	Q: see above (Rel.=.76)	see above (Rel.=.82)	.21 .22 .27 .33 .40 .43 .48 .50 .51 .53 .58 .60 .64 .67
			Physics		
Oehlert; (1977)	5/6	100 m/f	Q: Liking of physics instruction, readiness to achieve in physics (Rel.=.83)	Achievement tests: 1) Knowledge (Rel.=.89) 2) Transfer (Rel.=.86)	.53 .50
Todt (1978)	8/9	234 117 (m) 117 (f)	T: see above (Rel.=.98)	Grades	m: .24 f: .39
Todt (1978)	8–10	526 263 (m) 263 (f)	T: see above	Grades	m: .22 f: .11

Wendeler; (1968)	10	227 117 (m) 110 (f)	Q: see above (Rel.=.94)	Grades	.45
Skager et al. (1965)	10/11	524 261 (m) 263 (f)	Q: see above	Knowledge test	m: .32 f: .25
Todt (1978)	10/11	220 120 (m) 100 (f)	T: see above	Grades	m: .17 f: .33
Todt (1978)	10–12	146 89 (m) 57 (f)	T: see above	Grades	m: .43 f: .10
Todt (1978)	11/12	158 (f)	T: see above	Grades	.39
Todt (1967)	12	113 (m)	T: see Todt (1978)	Grades	.28
Sjöberg; (1983)	12	174 134 (m) 40 (f)	Q: see above	Grades	.48
Sjöberg (1984)	12	100 71 (m) 29 (f)	Q: see above	Grades	.49
			Biology		
Todt (1978)	8/9	234 117 (m) 117 (f)	T: see above (Rel.=.97)	Grades	m: .08 f: .07
Todt (1978)	8–10	526 263 (m) 263 (f)	T: see above	Grades	m: .13 f: .12
Wendeler; (1968)	10	227 117 (m) 110 (f)	Q: see above (Rel.=.95)	Grades	.27
Skager et al. (1965)	10/11	524 261 (m) 263 (f)	Q: see above	Knowledge test	m: .20 f: .21
Todt (1978)	10/11	220 120 (m) 100 (f)	T: see above	Grades	m: .16 f: .11
Todt (1978)	10–12	125 76 (m) 49 (f)	T: see above	Grades	m: .22 f: -.08
Todt (1978)	11/12	158 (f)	T: see above	Grades	.30

			Chemistry		
Wendeler; (1968)	10	227 117 (m) 110 (f)	Q: see above (Rel.=.94)	Grades	.43
			Social Science		
Wendeler (1968)	10	227 117 (m) 110 (f)	Q: see above (Rel.=.89)	Grades	.33
Wendeler (1968)	10	227 117 (m) 110 (f)	Q: 1) Ancient history (Rel.=.89) 2) Modern History/ Politics (Rel.=89)	Grades	.39 .35
Skager et al. (1965)	10/11	524 261 (m) 263 (f)	Q: see above	Knowledge test Grades	m: .35 f: .24 m: .35 f: .19
Todt (1978)	10/11	220 120 (m) 100 (f)	T: see above (Rel.=.96)	Grades	m: .41 f: .51
Todt (1978)	10–12	154 94 (m) 60 (f)	T: see above	Grades	m: .31 f: .20
Todt (1978)	11/12	158 (f)	T: see above	Grades	.32
Todt (1967)	12	208 (m)	T: see Todt (1978)	Grades	.26
Sjöberg (1983)	12	174 134 (m) 40 (f)	Q: see above	Grades	.41
Sjöberg; (1984)	12	100 71 (m) 29 (f)	Q: see above	Grades	.26
Hall (1975)	12 Junior Coll.	159 (m) 93 (White) 66 (Black)	Q: Interest in instruction, voluntary participation	Grades	White: .24 Black: .36

			Foreign Language		
IEA Study Carroll; (1975)	8	Samples from 6 countries $n > 839$ $n < 4420$ m/f	Q: desire for further education, liking the subject, quality of grades, importance of the subject (Rel.=.74)	IEA french achievement test (Reading) (Rel.= .85)	.22 .24 .26 .38 .42 .47
IEA Study Lewis & Massad; (1975)	8	Samples from 7 countries $n > 687$ $n < 2331$ m/f	Q: see Carroll (1975) (Rel.=.69)	IEA English achievement test (Rel.= .93)	.22 .28 .28 .38 .48 .49 .49
Skager et al. (1965)	10/11	524 261 (m) 263 (f)	Q: see above	Grades	m:.31 f:.16
IEA Study Carroll; (1975)	12	Samples from 7 countries $n > 378$ $n < 3230$ m/f	Q: see above (Rel.=.70)	see above (Rel.=.83)	.26 .28 .33 .35 .39 .41 .43
IEA Study Lewis & Massad; (1975)	12	Samples from 9 countries $n > 323$ $n < 2310$ m/f	Q: see above (Rel.=.65)	see above (Rel.=.82)	.18 .26 .27 .27 .27 .27 .29 .31 .33
Sjöberg; (1983)	12	174 134 (m) 40 (f)	Q: see above	Grades (English)	.41
Sjöberg (1984)	12	100 71 (m) 29 (f)	Q: see above	Grades (English)	.30
			Literature		
IEA Study Purves; (1973)	8	Samples from 9 countries $n > 548$ $n < 7228$ m/f	Q: Frequency of reading (Rel.=.66)	IEA literature achievement test (Rel.= .79)	.10 .12 .13 .16 .17 .17 .18 .22 .22