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Serge P. Shohov (Editor)



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SERGE P. SHOHOV (EDITOR)

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TOPICS IN COGNITIVE PSYCHOLOGY

PREFACE

Cognitive psychology is concerned with several mental processes, including those involved in perception, attention, learning, memory, problem solving, decision making and the use of language. It is often said that cognitive psychology tries to understand how people represent their experience and then use these representations to operate effectively. Cognitive psychology holds that people are not passive organisms whose mental representations are simple or direct reflections of the outside world. Rather, they are active processors of environmental events, and as such they bring their past knowledge and their biases to bear on how they perceive and understand all current events. Thus perceiving, imagining, thinking, remembering, forming concepts, and solving problems, indeed all aspects of people's mental lives, define the domain of cognitive exploration.

In this book, we present important research which was carefully selected and screened for both current relevance and long-term advancement of the field.

In chapter 1 advances in designing questionnaires to measure self-concept are described. Recent evidence involving the proper linear measurement of academic self-concept for university students (using the new questionnaires and a recently developed computer program based on a Rasch measurement model) support a different model of the formation and creation of academic self-concept. It is suggested that self-concept formation is dependent on at least four views of a subject or performance: an idealistic view, a capability view, a realistic view, and a self-view of their corresponding achievement in the subject or performance.

For many decades higher education pedagogic has been speaking about the need to consider students primarily the subject of teaching. But the realities of life outside and inside institutions of higher education have made these talks declarative for a long time. Have there been any changes in the motivation, contents and level of classroom and cognitive activity of modern students since then? In chapter 2 the authors tried to answer this question, having at our disposal the results of our studies of the *dynamics of classroom and cognitive activity* of the students of Samara State University (SSU), carried out for almost two decades.

In chapter 3 the factor structure of the WAIS-III in the 13 normative age samples was examined using principal components analysis for 1-factor (general), 2-factor (Verbal and Performance), and 4-factor (Verbal Comprehension, Perceptual Organization, Working Memory, and Processing Speed) solutions. For the 2-factor and 4-factor solutions an orthogonal procrustes rotation was used to rotate the loadings to the least squares best fit of

the hypothesis matrix. Congruence coefficients and root mean square differences were used to assess consistency of the subtest loadings across age groups and goodness of fit with the hypothesized structure.

Chapter 4 targets the topic of remembering the delayed execution of an intention, i.e. prospective memory. After specifying the significance of this research area, a model of prospective remembering is described identifying four phases in the process of forming and executing a delayed intention. The main part of the chapter summarizes recent work of the author concerning the question whether and how the importance of an intention influences the delayed execution. Three studies with five experiments are integrated presenting evidence for the author's resource-allocation-conflict-hypothesis.

In chapter 5 on the hypothesis of biologically conditioned intellectual giftedness in the monozygotic male-twins is suggested on basis of data on the strong connection between high intelligence in pre/adolescents and high testosterone level in the prenatal fetus development and also on the increased concentration of testosterone in the amniotic liquid in the case of pregnancy with monozygotic male-twins. The prenatal developmental peculiarities and unfavorable psychosocial factors during postnatal twins' development are discussed as the reasons for the phenomenological absence of talented male-twins in human history.

Family socialization practices, especially parent-child conversational interactions, play a paramount role in mediating children's acquisition of culture-appropriate modes of thinking, remembering, feeling, and behaving. In chapter 6, the authors draw upon empirical evidence on parent-child reminiscing in European American and East Asian families to analyze cultural variation in the cognitive, social, and emotional aspects of sharing memory narratives. It is demonstrated that parents in these cultures show different patterns and tendencies when conversing with their children about the shared past.

Many studies show that intended thought suppression often paradoxically leads to higher frequencies of unwanted thoughts. This effect has been linked to the development and/or maintenance of anxiety disorders. One important issue is whether the ability to suppress unwanted thoughts is generally impaired or specifically for thoughts related to the disorder. Chapter 7 discusses a clinical study of patients with agoraphobia and patients with social phobia who were compared with a control group without mental disorders. All participants were instructed to suppress two target thoughts related to the respective central fear of the two disorders and one non-specific item. During the suppression period, all occurrences of unwanted thoughts had to be signaled. Agoraphobics showed a rather specific deficit in thought suppression, while social phobics seem to be characterized by a general impairment of mental control, affecting specific as well as non-specific stimuli. Strategies used during the suppression task did not differ between target thoughts nor groups.

Most research on the important role of knowledge of results has been done on continuous spatiotemporal movements like in tracking tasks. However, few studies concentrate on the effects of training and feedback in discrete timing tasks. Chapter 8 gives an overview of studies examing the timing of movements in different tasks like the coincidence-anticipation task and the synchronization task as well as the effects of training in these tasks. A study is presented that analyzes the influence of knowledge of results on the timing of repetitive movements in a sensorimotor synchronization task. Informative feedback about the asynchrony between keypress and pacing signal is presented to test the hypothesis that the availability of augmented feedback is a precondition for learning in such timing tasks. The results obtained in the experiments clearly show that informative feedback is highly effective

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in reducing the (usually observed) anticipatory tendency, whereas no practice effects were obtained when subjects tapped without getting any feedback at all or with non-informative visual feedback.

Chapter 9 examined the effects of vocal and instrumental music upon the performance of introverts and extraverts on two different cognitive tasks. In the presence of either vocal or instrumental music or in silence, participants completed a reading comprehension and a phonological task. A significant interaction was found only for the phonological task possibly because of ceiling effects on the reading comprehension task. As hypothesised, music impaired performance of introverts more than extraverts, but extraverts' performance was not enhanced by the music as predicted. The study also examined study habit preferences and found, as predicted, introverts reported preferring to study in environments free of distraction.

In chapter 10 six experiments examine effects of overtraining on reversal learning in concurrent discriminations in rats. The findings of the six experiments in the study make it clear that stimulus-stimulus associations (i.e., stimulus classes) between the discriminative stimuli are formed in concurrent discriminations after overtraining, but not after criterion training.

Chapter 11 presents an approach to item pool design that has the potential to improve on the quality of current item pools in educational and psychological testing and hence to increase both measurement precision and validity. The approach consists of the application of mathematical programming techniques to calculate optimal blueprints for item pools. Three different types of design problems are discussed, namely for item pools for linear tests, item pools computerized adaptive testing (CAT), and systems of rotating item pools for CAT.

Cognitive psychology is concerned with several mental processes, including those involved in perception, attention, learning, memory, problem solving, decision making and the use of language. Therefore, it is very extensive and of great relevance to other areas of psychology. This book presents research on the leading edge of cognitive psychology.

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Chapter 1

THE STRUCTURE AND MEASUREMENT OF SELF-CONCEPT FOR UNIVERSITY STUDENTS

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ABSTRACT

The current model of the structure of academic self-concept involving separate maths and verbal domains plus separate subject self-concepts linked with a hierarchical general academic self-concept that is related strongly to each of the separate subject self-concepts, as proposed by Marsh and Shavelson (1985), is called into question.

Advances in designing questionnaires to measure self-concept are described. Recent evidence involving the proper linear measurement of academic self-concept for university students (using the new questionnaires and a recently developed computer program based on a Rasch measurement model) support a different model of the formation and creation of academic self-concept. It is suggested that self-concept formation is dependent on at least four views of a subject or performance: an idealistic view, a capability view, a realistic view, and a self-view of their corresponding achievement in the subject or performance.

* * *

The literature on academic self-concept is voluminous and academic self-concept is generally considered to be an important educational variable. Its importance mainly lies in its reported connection with academic achievement and academic behavior (see for example, Chapman & Tunmer, 1997, 1995; Chapman, Turner & Prochnow, 2000; Eccles & Wigfield, 1995; Marsh & Yeung, 1997a, 1997b; Muijs, 1997; Waugh, 2002b). Generally, students with positive self-concepts are more likely to have high academic achievement and to have positive academic behaviors towards studying and learning, and time-on-task: and the

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converse is generally true. This leads, in turn, to the importance of the structure of self-concept and how self-concept is formed.

The structures that have been given most attention in recent times are the ones proposed by Shavelson, Hubner and Stanton (1976), and the revised version that separately considers maths and verbal domains proposed by Marsh and Shavelson (1985). These structures propose a multi-dimensional set of separate subject self-concepts, with a hierarchical general academic self-concept that is related strongly to each of the separate subject self-concepts. There is a great deal of literature published in relation to the multi-dimensional (subject) nature of academic self-concept. Using True Score Theory to measure self-reported realistic academic self-concept, it has been shown time-and-again that students have different subject self-concepts (see for example Byrne, 1996; Byrne & Gavin, 1996; Harter, 1996; Hattie, 1992; Marsh, 1993, 1987; Marsh, Byrne & Shavelson, 1988; Vispoel, 1995). So there doesn't seem to be much question that academic self-concept is multi-dimensional, in the sense that students have different self-concepts for different subjects.

The question of whether academic self-concept is hierarchical in structure is more questionable than its multi-dimensional structure. There is much less evidence about its hierarchical structure, probably because a hierarchy is more difficult to test with True Score Theory measurement. There are three recent studies on the hierarchical structure, each providing some support for a hierarchy. In the first study, Yeung, Chui, Lau, McInerney and Russell-Bowie (2000) collected evidence to support; (one) a higher order global Creative Arts self-concept factor to represent Music, Visual Art, Dance and Drama for teacher education students; (two) a higher order global English self-concept factor to represent Speaking, Reading and Writing English for students learning English as a Second Language in a Hong Kong university; (and three) a higher order global Commerce self-concept factor to represent Accounting, Maths, Economics, English and Chinese for Commerce students in a Hong Kong university. In the second study, Marsh, Hey, Johnson, and Perry (1997) collected evidence to support a higher order Physical self-concept factor to represent six specific physical aspects for elite athletes from Australian representative teams and from a sports high school. In the third study, Vispoel (1995) collected evidence to support a hierarchical representation of a global artistic self-concept within a number of art subject domains, but not for a single higherorder factor that would 'explain' all the individual subject domains.

STRUCTURE CALLED INTO QUESTION

There are at least three aspects of these studies that can be called into question. One relates to the lack of a proper linear measure of self-concept. The use of True Score Theory only enables a rank measure to be obtained, not a proper interval-scale measure. Researchers need to obtain data for self-concept items that fit a linear measurement model of self-concept, not build a model from items that seem like they ought to make a good model. Two relates to how self-concept is formed and the lack of inclusion of ideal self-concept and self-efficacy (self-reported capability) in its theoretical structure and formation. How can it possibly be correct that students don't use an ideal self-concept or aim for some standard, using the standards they see on television and elsewhere, and their own self-capability, as depicted in the current models? The current structural models of academic self-concept are just not believable. Three relates to the proposed hierarchical structure that is not supported when

proper interval-scale measures are used. A hierarchical structure implies a top-down or bottom-up formation, none of which is supported when proper interval-scale measures are used.

Nearly all the studies of academic self-concept have used True Score Test Theory in the measures of self-concept and Confirmatory Factor Analysis to test for the hierarchy. Because a proper linear scale has not been constructed and used in these studies, the results are called into question. Wright (1999) argues the case for the use of proper linear measures in education and psychology. He suggests that no 'laws' of educational psychology have been discovered so far, as there are in physics and chemistry, for example, and 'laws' are unlikely to be discovered until researchers use proper linear measures of educational variables, such as Rasch measures (see Andrich, 1988a; Rasch, 1960/1980). This means that unless researchers use proper linear measures for academic self-concept, they are unlikely to find any 'laws' that link it to achievement or behavior, or which find out its structure and formation. There are available some Rasch computer programs that are easy to use and interpret, and they are reasonably cheap. One of the best is Rasch Unidimensional Measurement Models (RUMM) (Andrich, Sheridan, Lyne & Luo, 2002) and it has been used with a number of educational psychological variables such as motivation, approaches to study and self-concept (see for example, Waugh, 2002a, 2001, 2000, 1999). Not only can a Rasch computer program help test for a unidimensional interval-level scale, it can also test for a hierarchical structure.

The models of self-concept proposed by Shavelson, Hubner and Stanton (1976), and the revised version that separately considers maths and verbal domains proposed by Marsh and Shavelson (1985), do not involve ideal or capability self-views. Most of the measures of self-concept use only realistic items. Items relating to an ideal self-view and a capability self-view are rarely used. This comes about, at least partly, because there are strong positive correlations between real and ideal views. Marsh and Hattie (1996, p.77) have written, for example, that "ideal ratings typically do not contribute beyond what can be explained by actual ratings alone, and mean discrepancy scores have no more and, perhaps, less explanatory power than the mean of actual ratings". These comments are based on results from measures of self-concept that use True Score Theory and, as such, are called into question. There is a strong argument that people create their self-concept from an ideal self-view (see Waugh, 2001, 2000, 2002a, 2002b, 2002c), a capability self-view (see Bandura 1997; Waugh, 2002a, 2002b), and a real self-view. If one accepts this, and self-concept is related to achievement and behavior, then the self-concept measures, and the structural models behind these measures, should include all three aspects (ideal, capability and real).

While to some people, it may be reasonable to propose a general academic self-concept that is related to individual subject self-concepts in a hierarchical structure, the only test of this is by measurement. Do studies that use proper interval-level measures of academic self-concept provide evidence that support this proposed hierarchical structure? Up to 2002, there is only one study that uses Rasch measures of self-concept to test the hierarchical nature of the self-concept structure (see Waugh, 2002a). While this study does not support the hierarchical structure, there is a clear need for other studies to investigate this question.

VALUE OF RASCH MEASUREMENT

Rasch measurement produces data from which valid and reliable inferences can be made. Rasch measures produce interval-level data; it produces scale-free measures and sample-free item difficulties; it calculates person measures and item difficulties on the same scale; it checks that persons answer the response categories logically and consistently; and it checks that a uni-dimensional trait influences all the responses to all the items. True Score Test Theory does not make all these checks and hence is inadequate in helping researchers construct a proper scale. Researchers want a scale in which self-concept items are ordered from easy to hard, and calibrated on the same scale with the person self-concept measures from low to high. They want all the persons to agree that the same self-concept items are easy, that the same other items are moderately hard, and that the same other items are very hard. That is, researchers want persons with different measures of self-concept to agree on the difficulties of the self-concept items. They want persons with a high self-concept to have a higher probability of answering a self-concept item positively than persons with a low selfconcept, for any item along the scale. Only when there are such measures can researchers make valid and reliable inferences, and deduce some 'laws' of academic self-concept in educational psychology (a claim supported by Wright, 1999 and Waugh, 2002c).

Scale-Free Measures and Sample-Free Item Difficulties

When data fit a Rasch measurement model, scale-free measures and sample-free item difficulties are produced (Andrich, 1988b; Wright & Masters, 1982). This means that the differences between pairs of measures and pairs of item difficulties are sample independent and the mathematics behind the Rasch model support this. This means that the probability of answering a self-concept item is dependent on the difference between the person measure and the item difficulty on the same scale. In contrast, in True Score Test Theory, the sums of scores on the items and the item difficulties are not calibrated on the same scale, and the total score (which is a measure of the variable) is strictly sample dependent. Strictly, True Score Test Theory cannot produce anything better than a ranking scale that will vary from sample to sample. If researchers want to make a linear measurement of academic self-concept, this cannot be performed through True Score Test Theory (a claim made, for example, by Wright, 1999, amongst others).

Uni-dimensional Data

When all the items fit a Rasch measurement model, there is a uni-dimensional trait 'covering' and influencing all the items. Mathematically, this means that the probability of answering a self-concept item positively is only dependent on the difference between the person measure of self-concept and the item difficulty, for all persons and all items. This means that the measure estimated in Rasch modeling should be different from that calculated in True Score Test Theory. This could come about because the Rasch model will produce a different set of items contributing to the uni-dimensional trait than will True Score Test Theory based on inter-item correlation data. An ideal Guttman pattern of responses would fit

a Rasch measurement model. The argument is that a Rasch measurement model is needed to produce a proper linear scale in which both person measures and item difficulties are calibrated together on the same scale where a single dominant trait of self-concept influences all the items. True Score Test Theory does not make this test and hence cannot produce a proper linear measure. The main difference here is that, in Rasch modelling, only items that produce data that fit the measurement model are retained, whereas in True Score Test Theory, only items that produce good inter-item correlation data are retained. A recent movement in academic self-concept research is towards Rasch analysis that uses a uni-dimensional trait.

Check on Response Format

The RUMM computer program (Andrich et alia, 2002) uses a mathematically ordered threshold structure that corresponds with the conceptual ordering of the response categories for the items. The thresholds are boundaries located between the response categories. At a threshold, there are odds of 1:1 of answering in adjacent response categories. If respondents answer the categories consistently and logically, the thresholds should be ordered in correspondence with the order of the response categories. If thresholds are not ordered, then the item is discarded as not being able to produce valid and reliable data. In measuring variables like self-concept, there is a move to use response categories that are ordered from low to high, such as *never*, *sometimes*, *mostly*, or a low standard, a moderate standard or a high standard. No check is normally made on the logical and consistent answering of response formats in True Score Test Theory. So checking on consistency of data from response formats provides another test for good measurement and indicates why different items will be used in Rasch measurement, compared to those used in True Score Test Theory.

It needs to be noted here that Likert (1932) response categories (such as SDA, DA, U, A, SA) are not ordered from low to high, and they contain a discontinuity between DA and A. Although they have been widely used in the past, they should not generally be used in modern measurement. It is better to use an ordered response format.

Zero Point on the Scale

The zero point on a Rasch scale does not represent zero academic self-concept, necessarily. In a Rasch analysis, the zero point is usually artificial and represents the mean of the item difficulties, calibrated to be zero. It is possible to calibrate a true zero point, if it can be shown that an item represents zero self-concept. In True Score Test Theory there is no true zero point either. The difficulties of the items are not calibrated against the total scores (measures), and the items are not conceptualised or calibrated to form a scale from 'easy' to 'hard'. A zero score is usually the lowest score and is artificially made since there is no item measuring zero self-concept. In Rasch designed scales, items are now initially conceptualised and written in a number of sub-groups, from easy to hard (like several sets of Guttman patterns). The Rasch data analysis tests this conceptualisation and a zero point is not designed to be part of the scale, although it could be, if the researcher is clever enough.

Person-Item Interaction Tests

The RUMM program substitutes the parameter estimates back into the model and allows the researcher to examine the difference between the expected values predicted from the model and the observed values, using two tests of fit: one is the item-trait interaction and the second is the item-student interaction.

If the standardised residual between the observed and expected person parameters are not significantly different according to the item-trait test-of-fit (a chi-square), then there is no significant interaction between the responses to the items and the measures of the persons along the trait (see Andrich and van Schoubroeck, 1989, pp. 479-480 for the equations). This shows whether there is a collective agreement between persons of differing measures along the scale, over items of differing difficulty. That is, it provides a check that people with low, medium and high measures agree that certain items are easy, and that certain items are hard. It checks that there is a uni-dimensional trait that influences this ordering of the items. This is the main check that is performed to indicate a single global trait, if the items pass all the other fit statistics for forming a proper linear scale. No such check is normally done on this aspect in True Score Test Theory.

The item-person test-of-fit examines both the response patterns for persons across items and for items across persons. It examines the residual between the expected estimate and the actual values for each person-item summed over all items for each person and summed over all persons for each item (see Styles and Andrich, 1993, p. 914 or Andrich and van Schoubroeck, 1989, p. 482 for the equations). The fit statistics approximate a distribution with a mean expected near zero and a standard deviation near one when the data fit the measurement model. Negative values indicate a response pattern that fits the model too closely (probably because response dependencies are present, see Andrich, 1985) and positive values indicate a poor fit to the model (probably because other measures ('noise') are present). Again, no checks are normally done on this aspect in True Score Theory measurement.

The Rasch RUMM computer program automatically produces all these statistics and they can be checked to see that a good linear scale is produced, from which valid and reliable inferences can be made.

ADVANCES IN QUESTIONNAIRE DESIGN

Advances in questionnaire design involve ordering the items by difficulty in their initial conceptual design, and having each item answered in a number of ordered perspectives (such as an idealistic view, a capability view and a realistic view). This has advantages in data collection, checking construct validity, and measurement and interpretation. A particular problem, though, is collecting true data in line with the structure of the questionnaire. The structure has to be explained to the students and the students have to be counselled to answer the questionnaire correctly and truthfully, and be given, or allocated, sufficient time to do so. Students need to think about what they are answering. The common computer comment, garbage in, garbage out, is also true for measurement.

Ordering the Items by Difficulty

Measurement of academic self-concept implies that the items are ordered by difficulty from easy to hard, so that we can measure student self-concept from low to high (on the same scale). This means that the self-concept items are conceptualised and designed from easy to hard. Some examples of this are given in Appendix A (measuring English self-concept) and in Appendix B (measuring Physical Education self-concept). In Appendix A, for example, item 1 is Have an interest and ability in Reading. Item 2 is Have an interest and ability, and work hard to achieve in Reading. Item 2 is conceptual harder than item 1, because it involves item 1 and more, the more being working hard to achieve in Reading. Item 3 is Have a natural flair and ability in, and feel good doing, Reading. Item 3 is conceptually harder than item 2, because it involves item 2 and more, the more involves having a natural flair and feeling good doing Reading. So items 1 to 3 under the sub-heading Reading are conceptually ordered from easy to hard and this order can be tested from the student data analysed with a Rasch computer program, where the item difficulties and student measures are calibrated on the same scale. Items under the other sub-headings (Writing, Listening and Speaking) are similarly ordered from easy to hard.

Ordering the Item Perspectives by Difficulty

In Appendix A (measuring English self-concept), each item is answered in four perspectives: an idealistic self-concept, a capability self-concept, a realistic self-concept, and a self-reported achievement. It is expected that most students will order these perspectives from high (idealistic) to low (self-reported achievement). This is because an idealistic self-view involves what students would like, which is usually higher than their capability self-view, which in turn is usually higher than their actual self-view, which in turn is usually higher than their self-reported achievement. This order can be tested with student data, analysed with a Rasch computer program, where all the item difficulties and the person measures of self-concept are calibrated on the same scale.

SOME NEW RESULTS FOR SELF-CONCEPT FORMATION

Recently, Waugh (2002a, 2002b) has tested whether academic self-concept can be represented by a uni-dimensional trait when ideal self-concept, capability self-concept and real self-concept, together with self-reported corresponding subject achievement, are measured together on the same scale using a Rasch measurement model. Examples of the questionnaire that represent a new structure of self-concept are given in Appendices A and B. Samples were analysed in nine separate studies involving 15 subjects and 847 university students.

Drama students (N=135) were measured for separate Art, Music, Dance and Acting selfconcepts, and a global self-concept covering these four subjects. Art students (N=103) were measured for separate Art, Music, Dance and Acting self-concepts, and a global self-concept. Music students (N=103) were measured for separate Art, Music, Dance and Acting selfconcepts, and a global self-concept. These three groups were combined (N=343) and measured for separate Art, Music, Dance and Acting self-concepts, and a global self-concept. The results clearly supported three main conclusions. One is that ideal, capability and real self-concepts are linked and influenced by a single trait for each of the four subjects (Art, Music, Dance and Acting) for each of the three groups of students (Drama, Art and Music). Two is that single subject self-concepts could not be represented by a global self-concept for the combined students of Drama, Art and Music, except for Acting; that is, the data did not support the hierarchical structure postulated in the literature. Where the global structure was supported for Acting, an alternative hypothesis to the hierarchical structure is that this occurs for students who are trained to think and act in similar ways, only in subject combinations that are closely aligned by content and methods. Three is that ideal, capability and real selfconcept are linked to corresponding self-reported achievement by a uni-dimensional trait for each of the four subjects (Art, Music, Dance and Acting) for each of the three groups of students (Drama, Art and Music).

Science students (N=174) were measured for separate English, Science, Maths and Social Science self-concepts, and a global self-concept covering all four subjects. Maths students (N=118) were measured for separate English, Science, Maths and Social Science selfconcepts, and a global self-concept. These two groups were combined (N=294) and measured for separate English, Science, Maths and Social Science self-concepts, and a global selfconcept. The results supported three main conclusions. One is that ideal, capability and real self-concepts are linked and influenced by a uni-dimensional trait for each of the four subjects (English, Science, Maths and Social Science) for the groups of Maths and Science students. Two is that single subject self-concepts could be represented by a global self-concept for the combined students of Science and Maths for English, Maths and Social Science, but not for Science, and not for these four subjects and two classes combined; that is, the data provides some partial support for the hierarchical structure postulated in the literature. Where the global structure is partially supported, an alternative hypothesis to the hierarchical structure is that the global self-concept link occurs for students who are trained to think and act in similar ways, only in subject combinations that are closely aligned by content and methods. Three is that ideal, capability and real self-concept are linked to corresponding self-reported achievement by a uni-dimensional trait for each of the four subjects (Music, Dance and Acting) for each of the three groups of students (Drama, Art and Music).

Physical Education students (N=109) were measured for separate Physical Education, Sport and Health Science self-concepts, and a global self-concept covering all three subjects. The results supported three main conclusions. One is that ideal, capability and real self-concepts are linked and influenced by a uni-dimensional trait for each of the three subjects (Physical Education, Sport and Health Science) for the group of Physical Education students. Two is that single subject self-concepts could not be represented by a global self-concept for the combined subjects of Physical Education, Sport and Health Science. Three is that ideal, capability and real self-concept are linked to corresponding self-reported achievement by a uni-dimensional trait for each of the three subjects (Physical Education, Sport and Health Science) for Physical Education students.

English Language students (N=103) were measured for separate Reading, Writing, Speaking and Listening self-concepts, and a global self-concept covering all four subjects. The results supported three main conclusions. One is that ideal, capability and real self-concepts are linked and influenced by a uni-dimensional trait for each of the three subjects (Reading, Writing and Speaking) for the group of English Language students, and that a dominant trait was present for Listening. Two is that single subject self-concepts could be represented by a global self-concept for the combined subjects of Reading, Writing, Listening and Speaking. Three is that ideal, capability and real self-concept are linked to corresponding self-reported achievement by a uni-dimensional trait for each of the four subjects (Reading, Writing, Listening and Speaking) for English Language students.

SOME PRINCIPLES OF SELF-CONCEPT FORMATION AND LINKS WITH ACHIEVEMENT

The current model of the structure of academic self-concept involving separate maths and verbal domains plus separate subject self-concepts linked with a hierarchical general academic self-concept that is related strongly to each of the separate subject self-concepts, as proposed by Marsh and Shavelson (1985), is called into question. Recent studies with university students, using proper linear measures (Rasch measurement, see Waugh, 2002a, 2002b, 2002c, 2001, 2000, 1999) support a different method of the creation and formation of academic self-concept than is involved in the structure proposed by Marsh and Shavelson (1985). These studies support the following principles of self-concept, its creation as a latent trait by students, and its links with self-reported achievement.

- 1. Students create separate self-concepts about academic subjects (like Science) and their performances (like Acting) that they study at university, or watch on television, DVD or video. A particular student may create different subject and performance self-concepts that are not dependent on each other. In some cases the different self-concepts may be correlated because they are good (or bad, or mediocre) in a number of subjects, because they are trained to think in similar ways for the different (and perhaps related) subjects, or performances.
- 2. Self-concept formation is dependent on at least four views of a subject or performance: an idealistic view, a capability view, a realistic view, and a self-view of their corresponding achievement in the subject or performance. Students think about what they can do (an idealistic self-concept), what they think that they might be able to do, given their abilities and interests (a capability self-concept), and what they think they can actually do (a realistic self-concept). Most students find it easiest to have a higher ideal self-concept than a capability self-concept, which in turn is higher than their perceived realistic self-concept.
- 3. Students' academic self-concepts are not just based on a view of their abilities or achievements. While realistically perceived achievement may be causally predominate on self-concept for some students, both idealistic and capability self-concept both influence the creation and formation of academic self-concept.