

Learning Styles measurement or mis-measurement

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Executive Summary

This report reviews a sample of the available research on the role of learning styles in educational practice. It focuses upon research that has been published in journals rather than in conference proceedings, and in journals that can be accessed through the Monash library system. It has not used any material that was simply accessible from Web sites.

In defining the limits of the review, it does not cover some of the material from psychology and education including multiple personality and the work of Entwistle and Biggs. Measures in this area tend to be rarely used outside psychological and educational research and would require a different type of review to the one presented here.

The nature of learning styles is addressed and it is clear that there is confusion about how learning styles are defined and how they are distinguished from learning strategies, cognitive style and personality.

Various measures of learning styles are identified and the material that supports them is investigated. The Myer-Briggs Type Indicator is included because it has been used by a number of investigators as a measure of learning style.

Not one of the inventories that have been found have a current good reputation in the prime source for the evaluation of psychometric devices – The Mental Measurement Yearbook. Most have very poor reporting of reliability. There is little information on item characteristics including the definition of the basic measurement space that they cover. At best there is information on construct validity with very little on outcome or predictive validity.

There is, in effect, no data in the research literature that shows that learning styles are related to any learning outcomes, either qualitative or quantitative.

It is suggested that the use of the measures of learning style reported here is inappropriate. If an individual is interested in some other measure, a strategy is presented for coming to a decision about how to evaluate its likely usability.

The context – what the writers say

Learning style is a biologically and developmentally determined set of personal characteristics that make the identical instruction effective for some students and ineffective for others. (Dunn & Griggs, 2000:9)

Learning styles .. are innate preferences of individuals as to how they prefer to go about the process of learning (Wintergersta, DeCapuab & Itzenc, 2001:386)

Cornett asserted that students adjust their learning style according to the teaching style and task at hand. (Ladd & Ruby, 1999:363)

Theories of learning style assume that information processing preferences are relatively fixed (Carnwell, 2000: 1018)

[a cognitive] style is considered to be a fairly fixed characteristic of an individual, while [learning] strategies are the ways that may be used to cope with situations and tasks. (Riding and Cheema, 1991: 195)

Learning style is the way in which individuals begin to concentrate on, process, internalize, and retain new and difficult academic information.. (Dunn, Griggs, Olsen & Beasley, 1995: 353)

Few, if any, individual-difference test can measure an individual with complete accuracy, For this reason, the Learning Style Inventory (LSI) is not recommended as a tool for individual selection purposes. (A comment by Kolb in Delahoussaye, 2002:28)

In the real world, training occurs in a group context. Unless learning styles can be shown to apply to groups, their value will be limited. (Delahoussaye, 2002:28)

Do personality tests predict academic achievement?...A number of large scale studies in school and university populations have, however, produced equivocal results when attempting to test Eysenck's theory. (Furnham & Medhurst, 1995: 197)

Learning styles can be an expression, in the academic context, of more fundamental, and relatively stable, components of cognitive style and personality. Approaches to leaning draw attention to the critical importance of intentionality in academic learning... (Entwhistle, 1987:24)

A related area of learning theory, learning styles, has, in contrast, been the subject of considerable interest in accounting education. (Beattie, Collins & McInnes, 1997:Foonote 1)

..the author claims the concept of style is not taught in undergraduate classes because "Many educational psychology departments . . . use behavioral psychology as their base and sole tenets" . A more likely explanation is that students' knowledge, learning strategies, and interests are more important predictors of academic success than is style (Review of Gregorc Style Delineator in *The Mental Measurements Yearbook* on-line version)

1. Introduction

The context created with the quotes from the authors working in and around learning styles is designed to illustrate the range of conceptualisations that have been, and continue to be used by writers. It can be seen that learning styles range from being preferences to being biologically based. Some writers mix the two poles of the biology-environment dimension with little regard from the consequential issues.

In order to deal with the complexity of this area, this report has been structured to take into account the levels of interest readers are likely to bring to it:

1. *Introduction – general introduction to the issues*
2. *Defining and measuring – basic issues in definition and measurement*
3. *Learning styles and educational outcomes - basic material from the literature -expanded on in Sect.5*
4. *The ethics of learning styles measurement*
5. *The educational & psychometric evidence for the learning styles measures*
6. *The nature of learning style, cognitive style and personality – theoretical concerns*
7. *Choosing a measure of human behaviour - a practical guide to the process of choosing behavioural measures*

Why the Interest in Learning Styles?

I am not clear why learning styles has become a hot area of activity over the past 15 years. During the 1970's and 80's extensive work was done on student learning in higher education by a number of research groups, particularly those lead by Entwistle (eg.1987) in the UK and Biggs (eg 1979) in Australia. Some of this work is brought together by Richardson, Eysenck and Piper (1987). It would appear that some academics outside this mainstream educational psychology research latched onto the idea that if we could identify underlying approaches to how people learned then that would improve teaching. This is the type of approach that Felder & Silverman (1988) talk about and it is upon this that the whole of the Dunn enterprise is built (eg. Dunn & Griggs, 2000).

The primary difficulty with this is that it presumes a relatively direct relationship between learning style, teaching style and learner performance. Coupled with this is its failure to look at the learner as a psychological whole in the way eluded to by the Entwistle quote given in the *Context* as well as the comment upon the Gregorc SD.

What are the issues around learning style?

Learning style, cognitive style and personality are used in much the same context with similar and different measurement tools. Various authors have looked at how all of this might be conceptualised (Curry, 1983; Riding & Cheema, 1991) and others have actually done empirical work to attempt to make sense of it (Sadler-Smith, 2001).

Whether or not learning styles are important component of education is very much an issue in the eye of the author. The various ways in which learning styles are dealt with makes me question the whole concept and leads to a series of basic questions that I believe have to be answered if a teacher is to use any conceptualisation of learning styles in their teaching environment:

- a) *Is there a coherent definition of learning styles that allows for effective understanding of what learning styles are?*
- b) *Do measures of learning styles meet acceptable standards for use with students? Are they technically supportable as reliable and valid measures?*
- c) *Is there sufficient evidence of their relationship to educational outcomes to warrant their use?*
- d) *Is there an adequate understanding of the possible impacts of using learning styles on both teachers and students? Are there adequate safeguards to reduce negative impacts?*

These questions are obviously inter-related. If learning styles have not been adequately defined then it is difficult to see how acceptable measures can be produced. Similarly, the relationship between

learning styles and educational outcomes is premised on learning styles being both well defined and well measured.

I shall deal with all the questions, and associated sub-questions, in relative isolation from each other in order to give a reasonable analysis of the field.

The Scope of the Review

As a general point, the review covers very little material that is associated with the educational psychological work of Entwistle, Biggs, Sternberg and others. Most of the reported work by these people is in the professional literature from psychology and educational psychology and is technically complex. It has not been picked up in the general literature at anywhere near the same level as those quoted here. A separate review would be needed to deal with them rather than complicating the more general issues.

This review of learning styles covers data published in the past 5-10 years, although some papers go back 15-20 years.

In what follows I have only sampled the vast literature associated with learning style – quoting about 70 sources. This sampling has tended to restrict references to research papers published in the last 5 years (about two-thirds are within this time frame) although key conceptual and review papers are included that go back beyond that. I have used the past 5 years as my primary research period because many of the key critiques of the area go back some 10 years. Those doing these critiques have looked at the literature so there is little point in repeating these reviews. If the field is to respond to the critical material then it should be showing up in the published reports over the last 5 or so years.

Much of this review is restricted to journal articles.

Consequently, some may see holes based on what they know has been published in conference proceedings. My professional experience is that journals are more likely to publish well developed research and this reflects my interest in doing this review.

The decision was also partly defined by the fact that some of the poorest work in learning styles has been based totally on conference presentations – and presentations at international conferences associated with professional bodies. I would cite the work on the Felder-Solomon Inventory of Learning Styles (eg. Felder & Silverman, 1988) as the most telling example of this.

Another group of materials I have tend not to report are those that have little or no indication that they have read the literature and are often based on a single study.

These articles tend to be simplistic statements of adulation for some measure or other. Coupled with this are articles that show no understanding of data analysis (eg interpreting non-significant correlations) . Such articles raise questions of credibility about the journals within which they are published, which are often journals for teachers, industrial trainers or business education.

I have not used any material that comes from web resources.

Without any effort, I have found at least 5 web sites that, in talking about learning styles, include seriously misleading or downright incorrect information – and these have been academic web sites.

Most publications that are quoted here are available through the Monash Libraries.

As far as possible, I have steered clear of obscure journals. Obscurity is also defined as journals that may have a low status with professionals but have a popularist role.

This review also uses data from both secondary and tertiary educational systems.

There is also the odd paper from the primary system. The breadth is not a result of any shortage of studies but because it is important to show that the tertiary data is not based on, say, developmental issues. Learning styles had somewhat of a parallel growth in secondary, tertiary and business sectors, and I will attempt to illustrate what has happened across sectors.

2. Defining and Measuring Learning Styles

Is there a coherent definition of learning styles that allows for effective understanding of what learning styles are?

McLoughlin (1999), following previous attempts by Curry (1990), Riding and Cheema (1991) and others, has summarised her exploration of the learning styles area by giving the following definitions of the various terms used by writers:

Learning preference favouring one method of teaching over another

Learning strategy adopting a plan of action in the acquisition of knowledge, skills or attitudes

Learning style adopting a habitual and distinct mode of acquiring knowledge

Cognitive strategy adopting a plan of action in the process of organising and processing information

Cognitive style a systematic and habitual mode of organising and processing information

The implications of McLoughlin's summary are profound. The behavioural consequence of talking about *a plan of action* versus *an habitual mode* leaves with two very distinct levels of both likely action and intentionality in the way behavioural outcomes will be influenced in a given situation. The mode of using *a plan of action* is about attitudes and situational responses while *an habitual mode* is about behaviour that is in-grained, is something we do without thinking.

Notably, McLoughlin has not used biological assumptions as have been suggested by some writers. That is, some such as Dunn (Dunn & Griggs, 2000) believe that learning styles have some biological base; that we are pre-wired to have a certain learning style.

Do measures of learning styles meet acceptable standards for use with students?

There are a number of measures of learning styles and they include:

Canfield Learning Styles Inventory(??) - Canfield LSI

Dunn-Dunn-Price Learning Styles Inventory plus others (see Dunn & Griggs, 2000) - Dunn LSI

Felder-Solomon Inventory of Learning Styles (Felder & Silverman, 1988) F-S ILS

Gregorc Style Delineator - quoted but not accessible because it is purely a commercial product - Gregorc

Honey and Mumford's Learning Styles Questionnaire - H&M LSQ

Kolb Learning Styles Inventory (Kolb, 1987) Kolb LSI

Myer-Briggs Type Indicator (Briggs-Myers & McCaulley, 1992) - MBTI

Perceptual Learning Style Preference Questionnaire (PLSPQ) (used by Wintergersta, DeCapuab & Itzenc (2001) but only available from original author)

Vermunt Inventory of Learning Styles (reported by Boyle, Duffy & Dunleavy (2003)) - Vermunt ILS

The basic assumption in using any device that somehow impinges upon student behaviour is that the device will meet certain standards. These standards tend to have been set by bodies such as the American Psychological Association (APA) and are supported by local bodies such as the Australian Council for Educational Research (ACER). The standards relate to areas such as the validity and the reliability of a given device; that is the extent to which the device measures were supposed to measure and the extent to which it will remeasure the same thing on subsequent occasions.

Coupled with this is the "Bible" of psychometric testing, the Mental Measurements Yearbook (1998 plus on-line version), *aka* 'Buros'. Most behavioral scientists look to this particular resource as their

reference on the acceptability of a given test. This discussion may seem to be overly related to a given profession, but it is professional psychology that has provided the major training and conceptual input into the development of the assessment devices in education as well as in general psychology. Professional test developers in education will have had basic training in psychometrics.

Of the eight devices listed above, five have been reviewed in 'Buros'. The MBTI is treated purely as a personality device with no mention of its possible role in learning styles. The reviews of the other four are all scathing in the fundamental criticism they make of them, ranging from no justification for the method of development to no reliability and validity data (a common problem for all).

From all of this information, not one of the eight devices listed above should be used in any research in education.

3. Learning styles and educational outcomes

A detailed breakdown of the evidence for each is given in Section 5. Below is a summary of that material:

Dunn and Dunn measures (see Dunn & Griggs, 2000)

No support for its use in higher education and the evidence given for primary and secondary education open to serious questions.

Canfield Learning Styles Inventory

Very little data in the journals.

Felder-Solomon Inventory of Learning Styles (Felder & Silverman, 1988)

No support for its use as a measure of learning styles

Gregorc Style Delineator - quoted but not accessible because it is purely a commercial product

No support for its use although the available public data is very limited.

Honey and Mumford's Learning Styles Questionnaire

No support for its use as a measure of learning styles in education.

Kolb Learning Styles Inventory (Kolb, 1987)

Basically no support for its use in education as a way of defining learning styles

Myer-Briggs Type Indicator (Briggs-Myers & McCaulley, 1992)

No support for its use as a measure of learning styles.

Perceptual Learning Style Preference Questionnaire (PLSPQ) (used by Wintergersta, DeCapuab & Itzenc (2001) but only available from original author)

The example found of its use suggests that it is not well founded in the way it is structured.

Vermont Inventory of Learning Styles (reported by Boyle, Duffy & Dunleavy (2003))

The limited data makes it difficult to evaluate although it may have a reasonably good educational psychology base.

Is there sufficient evidence of their relationship to educational outcomes to warrant their use?

The general impression gained from the literature is that learning style research has, over the 40 or so years people have been looking at it, produced *no substantive data that establishes that learning styles influences learning performance*. What appears to be the case is that teachers would like learning styles to work and they continue to hope substantial data will be found.

For example, Snyder (2000) collected data on high school students and used the Learning Styles Profile. She correlated the LSP data against GPA and achievement scores for the students and found a number of significant correlations, although none exceeded 0.4 (accounting for 16% of common variance) and most were below 0.3. This level of correlation, although significant for a sample of 128 students, is of limited value when trying to talk about the structural relationship between two behavioural domains. Furthermore, simply having carried out correlations makes it impossible to define anything other than covariation, not causation. As with other studies, the analysis does not allow us to look at complex interactions between the various variables so that possible structural relations could be investigated.

van Zwanaberg et al (2000) have published predictive validity data on both the Solomon-Felder ILS and the Honey and Mumford LSQ. Their research sample of Engineering and Business Studies students showed zero-order correlations between the ILS and final exam performance. The LSQ also produced non-significant correlations. When the learning style data was correlated against the number of units the students failed, it was found that two of the LSQ scales gave small but significant correlations. They drew the conclusion that there was no justification for the use of either measures.

Skogsberg & Clump (2003) have used a version of Biggs (eg 1979) study process theory to look at the differences between psychology and biology majors. They find differences in majors but no differences across the groups in levels of academic performance. They go on to suggest that there is more work needed on learning style and performance if we are to understand differences in student performance. Unfortunately, they have not noted the comprehensive failure of previous research in this area.

One of the few papers that researched learning styles against a performance measure and found significant differences was that of Ross, Drysdale and Schulz (2001) on students in various courses at a North American university. They found that the mean GPA for the students differed on the scales of the Gregoric Styles Delineator (little is available on this device as the only reported data appears to be in the commercial manuals and nothing has been found in the professional literature). The largest set of data they analysed did show clear differences while a smaller set of data on education majors showed significant but trivial differences in mean GPA.

Perhaps the most interesting point about this paper is that in a section called 'Limitations' the authors pointed out that some students may not have answered the survey form correctly and they may also have failed to add up the columns correctly. Finally they admit that they have no biographic or background data (gender etc) that allows for any cross-validation of the result. For example, they did not have a breakdown by course major nor information on those who did the course voluntarily versus those for whom it was a compulsory subject.

In this section, I was looking for hard and soft data that would support a relationship between any of the learning styles measures and any form of educational outcome that was consequential upon learning styles. On the hard side I was looking for clear relationships between learning styles and student performance in meeting educational objectives. On the soft side I was looking for systematic analysis of data that showed students benefited from a learning styles based activity.

In my search of the literature I found no more than 10 papers that looked at educational outcomes as defined above.

The stability of learning styles

Cassidy and Eachus (2000) point to evidence that indicates that learning styles change in response to learning environments and that students report using different styles under different circumstances. No other papers have been found on this topic.

All measures of learning style are subjected to standard psychometric considerations (Kline, 1993) one of which is that they be reliable. Reliability is the extent to which a device is likely to much the same measure when it is administered another time. Each of the measures has varying degrees of reported reliability, but this is to be expected with measures of 'soft' behaviours. A quasi-standard for psychometric devices is that that should have average reliability coefficients of about 0.8 – most reported data is below this. There is debate in the MBTI area about its levels with the authors of the tool reporting reasonably good results in their manual.

Obviously, it is difficult to have stable measures when the definition of what is being measured is not always clear and when, in particular, it is not clear against behavioural outcomes.

4. The ethics of learning styles measurement

In this section I will deal with two particular issues. The first is the safety of using learning styles measures and the second is the validity of using learning styles measures across cultures.

Consequences of using learning styles measures

There appears to be a strange belief in the learning styles area that measuring these aspects of behaviour and then categorising people according to the types or traits is a non-controversial activity. On the one hand, users of learning styles measures say that the results reflect fundamental aspects of

learner behaviour yet on the other hand they do not think that these 'fundamentals' might not have had influences on wider behaviour if they are over-interpreted or misinterpreted.

Stellwagen (2001) talks about the silliness of saying 'You don't agree with me because I am type X and you are type Y'. This type of silliness can be heard in relation to the MBTI, the Felder-Solomon and almost all other devices being used by educators – although it does appear to be more likely when it is justified by Jung's type theory (no matter how debased that theory has become).

The ethical bottom line for any individual who intends to measure any aspect of human behaviour in any setting where that measurement can have effects on the future behaviour of the testee is that the measure should be well-defined and the testers should have appropriate understanding of consequences.

It is very rare to find that those using learning styles measures actually debrief testees on the limitations and meaning of the tool being used. I did not find a single MBTI paper that did a debriefing.

The assumption appears to be that these measures are coherent measures of behaviour, despite the complete lack of outcome or predictive validity data.

What appears not to be recognised here is that any measure of behaviour that deliberately tags people, can be detrimental to the well-being of some individuals.

Within Monash, human ethics considerations require that any intervention involves safe-guards that limit the amount of psychological collateral damage that can result from data collection activities. I would suggest that there are distinct failures within Monash to take seriously the issues surrounding the collection of potentially damaging psychological data.

If a measurement device is being used that cannot be shown to have any specific relationship to practical outcomes then its use is at best debatable and at worse unethical.

Learning style and cross-cultural factors

When any form of measurement device is being used in educational contexts, there should be some evaluation of the impact of culture on the responses to that device.

A paper on an Australian study on international students versus local students by Ramburuth & McCormick (2001) provides an excellent review of the research both Australian and overseas on differences in learning styles between cultures. It is notable that most studies are simply looking at differences in inventoried learning style and do not appear to include any outcome based measures. The study done by Ramburuth & McCormick used a different set of inventories to those generally reported in this paper but they failed to provide any data that showed these tools had been cross-culturally tested.

Wintergersta, DeCapuab & Itzenc (2001) researched learning styles in the language education area and found no cross-cultural differences between students from four language groups on the RLSPQ. They quoted other research that they say showed cross-cultural differences but most of these sources were relatively inaccessible.

Lam (1998) applied the Kolb LSI to a sample of sales personnel in Hong Kong who were taking part in a training session and found mean differences between learning styles and a single item performance assessment by their supervisor. Lam assumed that the Kolb structure held in Hong Kong even though he did not reported any data that established the cross-cultural validity of this device. The professional approach in psychometrics is that a device must be shown to be culturally appropriate rather than using it in its original form and then saying it is acceptable simply because you get mean differences.

A study of international students in business schools was carried out Ladd & Ruby (1999) using a device called the Canfield Learning Styles Inventory. With over 5 different nationalities in the study, the authors made no mention of cross-cultural validation of the device.

Rosati (1998) reports data on Canadian versus US engineering students that shows some differences on the MBTI. He indicates that there are no gender differences within engineering but there appear to be some differences associated with continuing or withdrawal. Unfortunately no concrete analytical data is presented in the paper to interpret the statements.

Lane, Nagai & Takagi (1993) looked at Canadian and Japanese business men and found differences on the MBTI that supported results from standard cross-cultural analysis but they failed to present the

actual mean data for a second-order evaluation of what they have said. This aside, they provide no information that shows the MBTI version they used had been validated for the Japanese population.

Saggino, Cooper & Kline (2001) have reported on the factor analytical profile for the Italian version of the MBTI. The results suggest that the factor pattern is unclear with three, four and five factor results being acceptable but this is further confounded by the factor that some indicator statistics are well below what would be expected. From their results, the MBTI would appear to have limited use in Italy.

In summary

In spite of the fact that learning style measures are used on a regular basis with populations different from those on which measures were developed, there appears to be very little detailed cross-cultural evaluation of these measures.

This is contrary to one of the basic tenets of professional test usage. It raises a range of ethical questions about the appropriateness of action that might be taken in using any of these measures.

5. The educational & psychometric evidence for the learning styles measures

Canfield Learning Styles Inventory

An Australia study by Smith (2001), using the Canfield Learning Styles Inventory simply shows students having differential learning styles but failing to associate this with any outcome measures. Furthermore, Smith's discussion suggests that educators should take note of learning style differences in spite of having no outcome data.

There are very few studies that use the Canfield.

The review in 'Buros' was highly critical.

Dunn and Dunn measures (see Dunn & Griggs, 2000)

The various measures that have been produced around the Dunn and Dunn learning styles model (eg. Dunn & Griggs, 2000) have been researched by a number of authors but the primary research seems to be associated with Rita Dunn's group at St. Johns University. In an attempt to respond to criticisms of their work, Dunn, Griggs, Olson, & Beasley (1995) presented a meta-analysis of research over about a 10 year period and drew the conclusion that the model was well-supported by the research. A basic critique of this analysis shows up some critical flaws. For example of the 24 studies, 18 were dissertations from Dunn's own group. There were no studies reported from peer reviewed professional journals, only dissertations. Where there were difficulties in the data, second order mediating factors were used to explain differences but the explanations of how these factors worked were not at all clear. Kavale, Hirshoren & Forness (1998) have published their disagreement with Dunn and her group on what the research is supposed to show.

The quality of the reporting of papers by Dunn and her group is, at times, very poor. In what she claims to be a definitive demonstration that the application of learning styles to the classroom helps disadvantaged students (Burke & Dunn, 2002), Dunn presents data that needs statistical information to support a claim for improvement in performance, yet she simply says that there is improvement. Added to this, she presents no information to establish the direct causal role of her intervention where differences might exist.

The two review from 'Buros' were both very critical across all aspects of the Dunn LSI.

Felder-Solomon Inventory of Learning Styles FS-ILS

FS-ILS has been used extensively in engineering and related areas and data has been presented at conferences but there is very little published in professional journals. A major critique of the FS-ILS was published by van Zwanaberg, Wilkinson, & Anderson (2000) where they came to the conclusion that there was little to support its use as a measure of learning styles. The FS-ILS has been used in an unpublished study across Monash, Deaking and TAFE and it was found that the FS-ILS was extremely poorly defined, with factor structures having very little relationship to what they were supposed to be.

Malgortzata (2003) attempted to establish the psychometric credentials of the FS-ILS but, unfortunately, she adopted a grapeshot approach in presentation of information, failing to recognise that many areas of her data were suspect against professional standards. For example, the reliabilities were generally below acceptable standards particularly when the device assumes type-based behaviour.

There is no evidence to support its use in defining learning styles in any context.

It is not reviewed in Buros.

Gregorc Style Delineator - quoted but not accessible because it is purely a commercial product

Honey and Mumford's Learning Styles Questionnaire HM-LSQ

The research by van Zwanaberg, Wilkinson & Anderson (2000) shows little support for using the HM-LSQ in education. It had no predictive validity against the performance of students in their course of study. That is, *learning style did not relate to academic performance*.

Duff (1997) and Duff & Duffy (2002) have found the psychometric characteristics of the HM-LSQ lacking. They show that reliability is below what would be expected and that the conceptual structure is not reflected in the actual psychometric performance of the device. They suggest that the HM-LSQ should not be used in Higher Education programs until it shows much better psychometric characteristics.

Furnham and Medhurst (1995) found that tutor ratings of student behaviours were correlated with only one scale of the HM-LSQ and that the scale (pragmatism) had no obvious educational interpretation. Tutor estimates of student final performance was non-significant for all but the pragmatists who had a negative relationship – the higher the score on the pragmatic scale the worse the estimation by the Tutor of final performance. There was no relationship between any of the scales and actual performance on their degree. This data is presented in a little detail because it has been used (eg. Swaile and Senior, 1999) to show the the HM-LSQ has outcome related validity when in fact there is none.

There is an interesting interchange between Swaile and Senior (1999,2001) and Sadler-Smith (1999) on the psychometric characteristics of the HM-LSQ. The initial paper by Swaile and Senior (1999) suggests that the structure of the HM-LSQ might not be what Honey and Mumford suggest and there may be only three, not four, learning styles. Sadler-Smith responded with a series of technical comments including a re-think of the Kolb-based structure of the HM-LSQ. Swaile and senior responded with an acceptable set of technical points.

The importance of this interchange lies in the fact that there is the assumption that the HM-LSQ is actually doing something. The data to date suggests that the HM-LSQ has no relationship to anything. It does not matter if a large number of work places are using the device in training and staff development (Sadler-Smith,1999:1), there is no evidence to support that use.

Kolb Learning Styles Inventory K-LSI (Kolb, 1987)

The K-LSI is more difficult to critique than some of the others. It grew out of Kolb's work on independent learning and, in that sense, has a strong foundation. Unfortunately, the data on its actual performance is extremely mixed and generally does not support its use any any 'strong' way. The review in 'Buros' was highly critical.

The validation data on the Kolb LSI in education environments is limited. More work has been done in the industrial training area. Bostrom, Olfman & Sein (1990) generated a complex research program to test the role of the Kolb LSI in training. In their literature review they pointed to clear shortcomings in the available data on the validity of the measure. The results they obtained suggested that the Kolb LSI had a mixed pattern of relationships to the training tasks they used. Ruble & Stout (1993) criticised Bostrom, Olfman & Sein on the grounds that the psychometric characteristics of the Kolb LSI were far below what was needed to do that type of study. The response by Bostrom, Olfman & Sein (1993) was interesting in that they argued that we should not have to wait for the perfect tool in order to carry out research.

It is important to recognise that the broader information on learning styles was not very positive but also Kolb had had the LSI on the market for some 15 years by the time the 1990 study was carried out.

Wang, Hinn and Kanfer (2001) used the Kolb LSI with students using computer supported

collaborative learning and found that learning style had no influence on neither academic performance outcomes nor upon student satisfaction. An interesting component in this study was that the researchers looked at changes in learning style over the period of the course and found that even though there were changes in measured learning style, which would be expected under the Kolb model, this had no influence on satisfaction or performance. Bandy & Young (2002) also found changes in style after exposure to different teaching methods but they did not have a comparison against academic performance.

One of the few studies that has looked at an e-learning environment failed to find any differences between performance in traditional and e-learning due to either learning style as measured by the Kolb-LSI or a measure of learning environment (Buerck, Malmstrom & Peppers, 2003).

The evidence tends to point to the rejection of the K-LSI in any context where the aim is to classify students into any learning oriented groups. Outside of that, a user should read Kolb in depth to understand ways in which it might be used.

Myer-Briggs Type Indicator MBTI (Briggs-Myers & McCaulley, 1992)

The MBTI has an extremely ambiguous position in this report. It started life as a personality type indicator but has become a universal descriptor for all things human.

Ramsay, Hanlon & Smith (2000) typify much of the subject specific research into the relationship between the MBTI and student learning behaviour – apart from the fact that they call the MBTI a measure of Cognitive Style. Under the research assumption that accountancy students would have references for cooperative programs dependant on MBTI profile, they found some indicators of difference based upon the EI dimension but failed to find other differences which they said would be implied by the literature.

The evidence to support the MBTI as a measure of learning styles is non-existent.

The review in Buros relates to the MBTI as a measure of personality.

Vermont Inventory of Learning Styles (VILS)

The VILS is a relatively unreported measure of learning styles, coming from Holland but being taken up in the UK. Vermunt (according to Boyle, Duffy & Dunleavy, 2003) has utilised constructivist thinking in conceptualising and developing the VILS.

Boyle, Duffy & Dunleavy (2003) found that, for a UK sample, the VILS' factor structure held together but that the correlations of factors with academic performance did not follow the theory at all well. They drew the conclusion that the research subject were adaptable and responded to the learning environment rather than to their style.

Perceptual Learning Style Preference Questionnaire (PLSPQ) (used by , DeCapuab & Itzenc (2001) but only available from original author)

6. Learning style, cognitive style and personality

What follows is not an attempt at an introductory course in cognition, affect and learning. It is primarily an attempt to point to various definitions that illustrate the complexity of this material.

Curry (1983, 1990) is seen as having made a decisive impact on the area with her so-called onion model, but unfortunately it is a model that is often dealt with poorly in the Web-based materials. The basic point that she made was that the structural relationship between learning style, cognitive style and personality can be seen as a movement from core psychological characteristics through more superficial characteristics. Personality is seen as a core characteristic, cognitive style is seen as moving away from the core while learning style is seen as being a superficial psychological characteristic.

What has to be recognised is that the formal definition of these psychological characteristics is not well-defined. There are variations in definitions depending on the background theoretical position of a given psychologist. Personality is a good example.

Personality: Personality is a person's unique behavioral and cognitive patterns; OR, a person's unique consistent pattern of thinking, feeling, and acting. For example, some individuals have personality characteristics tending towards shyness and introspectivity while others tend to be outgoing and

extroverted. Because personalities, by definition, are stable patterns which cannot be changed easily, there has been great debate between personality theorists and social psychologists about the actual impact of personality on behavior, thought, and emotion. For example if someone is shy, does that mean that they will virtually never act in an outgoing manner? [<http://www.alleydog.com/glossary/definition.cfm?term=Personality>]

Personality, as perceived by the dynamic psychologists (Freud and those from that general area) would say that personality is an abstraction for the way in which all the dynamic components of the human psyche interact to give the thing we know as the person. They tend to say that it can be objectively defined through understanding how the psychological components develop. Even Jung, with his later collective unconscious and other mystical components had difficulty with the personality being highly definable. At the other extreme, the traditional behaviourist would also say that the personality is definable and that it is the characteristic set of habitual patterns of behaviour that are a reflection of the individuals learning history. Personality becomes much more difficult to define for the phenomenologists in that if we are creating our own reality, the other person is simply a construct that we create.

Personality can mean many different things although it can be broadly seen as some type of characteristic set of responses we make in dealing with the world.

Personality in its many incarnations is assessed by a wide range of tools. Many have their origins in attempting to diagnose abnormal behaviour. The most notorious would be the Rorschach Inkblot Test, a set of cards with inkblot patterns. There are theory-based devices such as the Repertory Grid for Schizophrenia and there are many measures derived from psychometric research.

But where does it come from?

Some would say that it has a biological base while others strongly see it as a result of continuous interaction with the environment.

Cognition: All the mental activities associated with thinking, knowing, and remembering. As you can tell, any of your ideas, thoughts, memories, etc., are all types of cognitive processes. What you are doing (reading and learning this explanation) is a type of cognition. [<http://www.alleydog.com/glossary/definition.cfm?term=Cognition>]

Refers to the mental processes of comprehension, judgment, memory, and reasoning, in contrast to emotional and volitional processes. Contrast with conative.

Cognition is, at one level, more straight forward. Cognition is about thinking and reasoning

Riding & Cheema (1991) and others have actually done empirical work to attempt to make sense of it (Sadler-Smith, 2001)

Cognitive Style is a well researched component of human behaviour. Witkin and his associates (Witkin, 1977) used a variety of complex measures to define the behaviour and to develop the concept of field dependence/independence. They started with a complex piece of machinery called the tilted-room-tilted-chair apparatus, moved onto more mobile tools and then produced the Embedded Figures Test. To make assessment even more convenient, a group administered version of the Embedded Figures test was developed and that has been duplicated by others.

Learning styles has no such substantive base, except for the writing of Kolb. It was Kolb who did early work on defining the self-directed learner and then produced the staged process model of knowledge acquisition. He utilised Jungian concepts although his actual implementation can hardly be seen to be Jungian. The other attempts to use Jungian concepts, such as by Fielder and Silverman, lack any link to actual Jungian theory. Jung, himself, may have made some comments about learners but he did not have a theory of learning.

If learning styles are seen as preferences then they belong in a fairly superficial area of human behaviour – an area where response patterns change depending on experience and circumstances. There has been research in social psychology and sociology that shows stated preferences do not necessary relate to actual behaviour – what I say I will do does not always result in actual behaviour.

If we compare this level of behaviour with a cognitive response that links to a range of normal activities, that are not dependent upon affective factors, then we have a different level of behaviour.

To this extent the idea of an onion effect as suggested by Curry (1983) is not an effective analysis of the relationships between these constructs. In fact, any attempt to distinguish between them must have

some basis in the behavioural processes involved. That is, we cannot restrict our self to a superficial relationship with a particular situation rather we must look at what actual behaviours occur in any situation.

As preferences, learning styles are a high level mix of behaviours. All research into preferences (including occupational interests) provide little or no relationship with actual outcome behaviours partly because the preference is this high level mix of other things. A preference is made up of:

positive and negative feelings about a set of objects
cognitive components such as level of understanding of content
attention issues related to the attractiveness of the situation
motivational issues reflecting our desire to be there

7. The nature of traits, characteristics and types

At the background of all activities that intend to measure human behaviour are some assumptions about the underlying nature of that behaviour. Psychology tends to distinguish between those things that are called types and those things that are called traits or characteristics. Much of clinical screening, personality evaluation and educational evaluation is based on how we define behavioural groupings.

Meehl (1992) has pointed to the essential differences between traits and types, and yet the literature still fails to come to grips with the importance of this. For example, the structure of the MBTI and the Felder-Solomon are derived from Jung's writing on personality types (Jung, 1971) yet the implication type theory in educational assessment is rarely addressed.

If we are defining behaviour as a type then this is what is illustrated in Figure 1. There are no gradations. You are either introverted or you are extraverted. This is what Jung appears to have been saying.

If we are defining behaviour as a trait then we have the situation shown in Figure 2. People are distributed along a continuous dimension from Introverted to Extraverted. It is only those people at the extreme ends of the distribution who are clearly either introverted or extraverted. A further consequence of the trait approach is that in the middle of the distribution you have about 60% of the population and that this 60% is neither clearly introverted nor clearly extraverted. This is the position of those developing many diagnostic personality inventories.

The behavioural consequences of taking one or the other approach are obvious. At the most basic level, when you administer a tool that uses type thinking you are saying that individuals *will be categorised according to a typology*. Furthermore, you are also saying that this categorisation as a fundamental part of the person's being – it is not something that can be easily modified. Against this, the results from a trait-based device are about the position along the continuum with the understanding that the majority of respondents will not belong to any clear grouping of behaviours. Depending upon what you are measuring, the behaviours may be modified. For example, most personality measures would say that the introversion-extraversion based behaviours can be modified.

The status of current measures as type measures is open to debate. Arnau, Green, Rosen, Gleaves, & Melancon (2003) make a strong case that shows the MBTI and two other measures associated with Jungian Type Theory do not measure categorical types but more likely measure continuous traits. But they also point to the confused nature of Jung's own position:

Jung (1971) also maintained that his descriptions of types were prototypical descriptions that were only valid when the preferences were clear and habitual (Garden, 1991, p. 8). In fact, Jung also pointed out that there are some people who use both attitudes or functions equally and other people who do not use either one with much frequency (cf. Garden, 1991; Saunders, 1988). For example, regarding Introversion and Extraversion, Jung (1971) wrote: “There is, finally, a third group, and here it is hard to say whether the motivation comes chiefly from within or without. This group is the most numerous and includes the less differentiated *normal man*” (pp. 515–516, emphasis added).

(Arnau et.al., 2003; p.235)

The factor analytical research into the Felder-Solomon ILS does not produce results that resemble a simple categorically structured set of types – it is quite confused (van Zwanaberg et al, 2000; Malgortzata, 2003).

Traits may be easier to think about but their actual role in measuring learning styles can lead to some interesting problems of interpretation. Assume that we have the situation shown in Figure 3. That is, there are three measures, Z, X and Y, that are relative symmetrically distributed. The vertical lines represent the mean for each measure. Extrapolating from various papers, we could easily have a set of data where the differences between Z, X and Y are similar to what is shown here and have statistically significant differences. If we look at the common area of overlap in the middle of the three distributions, you can see that a number of people could not be differentiated yet the mean trend is that Z, X and Y are statistically significantly different.

Figure 4 presents an even more difficult issue for research and practice. Learning style measures are often used in educational setting to explore the conditions under which students fail to prosper due to learning style conflicts (and I disregard the sheer over-simplicity of the basic hypothesis for the sake of demonstration). What we have in Figure 4 is again an extrapolation from those reports that do find significant differences and where we have the relationship between those who continue on a course and those who withdraw. The question is “What decision can the educator make about continuing and withdrawal given the fact that all withdrawing students are contained under the continuing student distribution?”. In many educational research situations where you are looking at differences between groups, the problem of the practical interpretation of this degree of overlap is not uncommon.

Summary

Most behavioural research assumes that a measured aspect of behaviour is on some continuous scale from little to much, rather than being on an all or none basis. The research into measures such as the MBTI that assumes the all or none model does not give unequivocal support for that model.

8. Choosing measures of human behaviour

There is a definable set of criteria that should go with the selection of any measure of human behaviour.

The device should have clear validity studies carried out on its area of operation

That is, there should be properly designed studies (that can be qualitative as well as quantitative) that show that the device does what it is supposed to be doing.

Learning styles measures lack concrete data, particularly by independent investigators, that show that students do have different learning styles and that these learning styles influence their educational outcomes.

Any educational or psychological measure must be able to be sourced to its original paper

You, as the potential user, should be able to check out the rationale upon which the device was based and to be able to relate that to your needs and your pedagogical thinking.

For example, I have not been able to find a paper by Felder and Silverman that actually gives the structural development of the FS-ILS. Felder & Silverman (1988) talks about the device but not its technical origins.

Look beyond the Web and the conference literature .

Look for publications in reputable journals. Any psychometric device should have been critically discussed in *Educational and Psychological Measurement* or a similar professional journal.

The Felder-Solmon ILS has not been discussed in a major journal oriented to psychometrics although van Zwanenberg & Wilkinson (2000) published a highly critical review in *Educational Psychology* .

The MBTI rarely appears in main-stream professional psychology journals. Most of the research reports are in the *Journal of Psychological Types* and related 'in house' publications.

Look uses of the device outside of the area in which it was developed .

If a device is about Learning Styles then you would expect other educationists to take it up and to

research it. The Felder-Solmon ILS has almost exclusively been used in engineering education with a limited exposure in computing education (eg. Armarego et al, 2001) .

Beware of any test that is mainly talked about within a narrow set of publications, particularly when those publications are intimately related to the test

For instance, many psychologists are very concerned about the fact that the vast bulk of the publications on the MBTI are in *The Journal of Personality Type* and bulletins of special interest groups. Any test associated with specialist area should be discussed in the broad group of professional journals belonging to that area. There are less than a handful of MBTI articles published in *Educational & Psychological Measurement* a long-standing premier journal on tests and measurement.

The Felder-Solomon ILS should flag a warning because the papers on it are almost solely published in the engineering education conference publications.

The Kolb LSI is fairly widely reported but its strongest support comes from the business area, yet even there generates little strong professional analysis.

A mcomplex selection criterion is based upon the papers that attempt to evaluate the test

The papers must have the balance of content that shows the writer knows what he/she is doing and that the content is not an attempt at a whitewash of the shortcomings of the test.

The van Zwanenberg & Wilkinson (2000) paper is a very competent comparative analysis of the ILS and Honey-Mumford questionnaire. Against this, the Malgortzata (2003) paper on the FS-LSI lacks 'distance' and can also be criticised for the relative naivety of the analysis. For example, the failure to present a clear picture on the factorability of their data and the lack of clarity on item-total correlations.

Two other good examples of review papers are Pettinger (1993) on the MBTI and Stellwagen (2001) on learning style in primary and secondary education. Garner (2000) illustrates a very analytical approach to Kolb and the LSI.

If in doubt, get professional advice.

Collect the key bits of information you have about the measure you are looking at and find a psychologist, or other social scientist, who works on test development and psychometrics. But make sure that you have eliminated all the obvious sources of shortcoming before you do so – appears to be validation research appropriate to the device, research published in appropriate journals, not based on web referencing.

9. Summary and conclusions

This review of the literature on the measurement of learning styles, using devices not developed within the constraints of a behavioural learning theory, says that it is improper to use such measures. It is improper because they have not been shown to do what they purport to do. Therefore any use can produce unpredictable results. In addition, use is not justified because few of the devices begin to meet the professional standards associated with measures that can influence human behaviour.

For the learning styles area to be relevant and useful in higher education, there needs to be a coherent program of research into the role of learning styles (however defined) in the actual outcomes of learning activities. The research has to go beyond the rather simplistic attempts to show people differ on a measure to showing that these differences lead to definable learning outcomes. To date, this has not been the case.

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