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The Nexus Explored: A Generalised Model of Learning Styles

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Abstract: The controversy over learning style (the unique way of thinking and reasoning that characterises an individual learner) as to whether or not it is a stable cognitive factor is one which has raged on for a number of years, and has been reinvigorated recently with the advent of easy-to-use courseware development tools and the consequent development of virtual learning environments. This paper surveys a number of different learning styles models and it concludes there is a large degree of commonality between the different theories, which allows us to distil key or core learning style characteristics which point the way to a number of styles of teaching which should be addressed in every learning environment. A model of this core set of dimensions is presented which unifies the various learner styles presented by others.

1. Introduction

In the information age that we now live in with all its demands for web-literate and highly flexible employees, the question of how an individual learns becomes of paramount importance. Learning depends on a large number of factors, many of which are specific to the individual person. The individual learning style represents the particular set of strengths and preferences that an individual or group of people have in how they take in and process information (Felder 1996). The idea of a learning style is certainly a controversial one, and one which there is little agreement over. Everything from the exact definition of learning styles to the very existence (and stability) of learning styles has been hotly debated. The most commonly accepted definition is by Keefe (1979) who defines it as "the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment."

The debate over the importance of learning styles has re-emerged recently with the availability of easy-to-create multimedia educational materials, for both traditional and on-line environments. Most educators "agree that learning styles exist and acknowledge the significant effect that learning styles have on the learning process" (Vincent & Ross 2001). There is also general agreement that the most effective learning occurs when the learning activities most closely match the learners preferred style. By matching the instruction style (through the intentional use of a variety of instructional approaches) with the various learning styles of the learners we ensure that the learning process is a comfortable and easy one. This matching can be of particular benefit to new college students where most attrition occurs. Mismatching can sometimes be appropriate to help learners develop the mental dexterity they need to reach their potential for achievement in school and as professionals. However any mismatching needs to be handled with sensitivity and consideration as the experience of discontinuity can be threatening to learners, to such an extent that it can interfere with their learning processes.

The three main criticisms which argue strongly against the use of learning styles are: that learning styles result in the stereotyping or pigeonholing of the learner, that learning styles are not a stable cognitive factor over time, and that learning styles are not stable over different tasks and situations. We contend that the development of new courseware tools which allow the easy creation of multimedia education materials can serve to counter these criticisms, as well as providing the opportunity to assess and address learning styles in an entirely novel fashion. We feel that this in conjunction with our new learning styles model, which extracts the 'core' dimensions of other learning styles models, can result in learning styles becoming a significant tool in the arsenal of the professional educator.

2. Introduction to Learning Styles Models

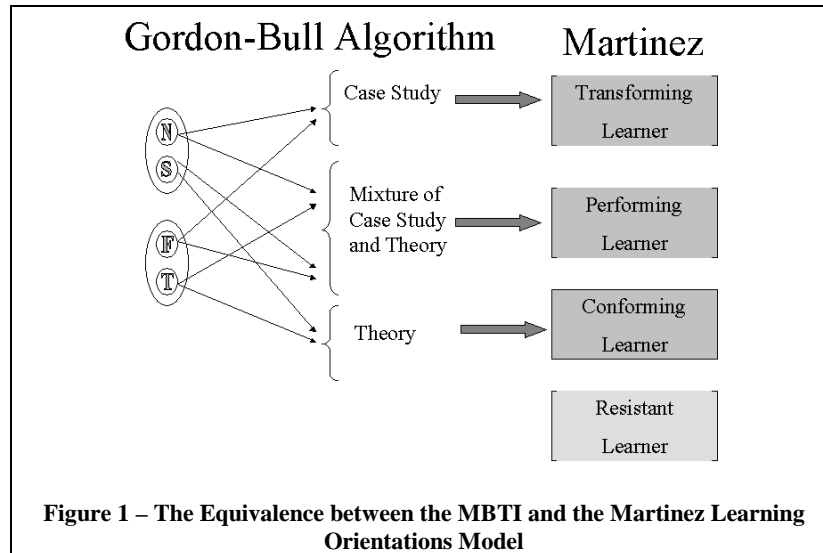
There are many hundreds of examples of models which measure a range of factors, from whether the learner prefers information presented visually or verbally (Dual Coding), if the learner likes to take a global perspective or a more sequential approach (Felder-Silverman Model), to whether they are competitive or collaborative learners (Grasha-Riechmann Model). Two of the oldest models of learning styles are Witkin's Field Dependence / Field Independence Model (Witkin 54) and the Myers-Briggs Type Indicator (Soles & Moller 01). Witkin's model divides learners into two discrete categories: *Field Dependence* learners and *Field Independence* learners. Field dependence learners are those who are externally motivated, like to work collaboratively and are people-oriented. Field independence learners are intrinsically motivated, work independently or competitively, and take an impersonal approach to learning. In contrast the Myers-Briggs Type Indicator has been in existence for over fifty years and is a learning styles instrument which uses four dimensions, each of which classifies the learner as being one of two polar opposites within that dimension. The particular types are: *extraverts* (who work things out) or *introverts* (who think things out); *sensors* (who focus on the details) or *intuitors* (who focus on concepts); *thinkers* (who conclude based on logic) or *feelers* (who conclude based on feelings); and *judgers* (like to finish what they start) or *perceivers* (always searching for more).

The now standard method of classifying learning styles models is the Curry 'Onion' Model (Curry 1983) which divides learning styles models into four layers of categories: *Personality Models* - these models focus on the influence of personality on the ability to acquire and integrate information, *Information Processing Models* - focusing on the processes by which information is obtained, sorted, stored and utilised, *Social Interaction Models* - focusing on how learners interact with their peers in the learning, and *Instructional Preference Models* - focusing on the most observable traits of a learner, examples of which are environmental, emotional and sociological preferences. In the Curry Model each layer focuses on different aspects of the learner and how they learn. In the following section we will demonstrate an alternative way of categorising (or demonstrating equivalencies between) different learning styles models.

3. The Equivalence between the MBTI and the Martinez Learning Orientations Model

In Gordon and Bull (2003), we demonstrated how the Myers-Briggs Type Indicator can be used to inform the type of instructional materials a learner would like to interact with, in particular, both the *Sensor/Intuitor* (S/N) dimension and *Thinker/Feeler* (T/F) dimension allow an instructor to determine the appropriate combination of theoretical and practical work that the learner would be most comfortable with in their learning environment. Based on the description of their dimensions, the *Sensor* is most comfortable understanding the theories behind a concept, whereas the *Intuitor* will be more comfortable taking a practical approach to learning, using case studies or real-world examples. Similarly, the *Thinker* likes a theoretical approach and the *Feeler* likes a practical approach. Therefore the four possible combinations of these dimensions are ST, SF, NT and NF, which result in preferences for Theory/Theory, Theory/Practicals, Practical/Theory and Practical/Practicals. These four combinations boil down to the following: based on the type of learner as categorised by the Myers-Briggs Type Indicator, one should instruct them using either a mostly theoretical approach, a mostly practical-based, or an equal combination of both.

The Martinez Learning Orientations (Martinez 00) describes four kinds of learners: *Transforming*, *Performing*, *Conforming* and *Resistant*. The *Transforming* learner assumes learning responsibility and self-manages goals, enjoys practical-based learning. The *Performing* learner will assume learning responsibility in areas of interest but willingly gives up control in areas of less interest, enjoys a combination of practical-based and theoretical learning. The *Conforming* learner assumes little responsibility, wants continual guidance and is most comfortable with theoretical knowledge. Finally, the *Resistant* learner chronically avoids learning. It is clear that the first three types of learners in the Martinez Model can be identified also through use of the Myers-Briggs Type Indicator, since they both recommend an equivalent combination of theory-based and practice-based teaching (see Fig. 1).



This equivalence can also be seen in the relationship between the Myers-Briggs Type Indicator and the Keirsey Temperament Sorter II (Keirsey 88), which classifies learners as *Guardians*, *Idealists*, *Artisans* and *Rationals* (explained in Table 1). The *Guardians* are identified with the SJ learners of the Myers-Briggs Type Indicator, the *Idealist* learners with NF learners, the *Artisan* learners with SP learners, and the *Rational* learners with NT learners. This suggests that it is possible to develop associations (and demonstrate equivalencies) between different learning styles models focusing exclusively on the specific dimensions within the models (and what that tells us about the learner) in contrast to the Curry Model which looks at the overall model to categorise what aspect of learning is being measured.

The Myers-Briggs Type Indicator categorises learners according to four dimensions, each of which classifies the learner as being one of two polar opposites within that dimension, this results in a total of 16 possible combinations of learning types. This is a considerable number of different styles and may be too many for students and faculty to assimilate and differentiate. Therefore a lesser number of dimensions (as in the Keirsey Model) may be more preferable. This may seem counter-intuitive, but the benefit of going from a more specific, highly-dimensionalised descriptive model to a less specific model with less dimensions is that it results in a more inclusive model, one which includes a wider range of learners within its scope. Another key advantage to a more general model is that it is easier to implement an on-line learning environment based on such a model. The development of both the learner style assessment process and the delivery of educational materials within that style are more practical within a limited number of styles.

With the above in mind it is worth noting that the Keirsey Temperament Sorter II is one of a number four quadrant learning styles models. This range of models are now investigated to determine if a strong degree of similarity exists between this particular 'family' of learning styles model. The purpose of the investigation would be to determine if there are any dimensions which are common to most of these learning styles, since these could therefore be considered as 'core' dimensions which every learning environment (real or virtual) should address.

4. The Four Dimensional Learning Styles Models

The four quadrant models under review are; the Keirsey Temperament Sorter II (Keirsey 88), the Kolb Model (Kolb 95), Hermann Brain Dominance (Dew 96), the Honey-Mumford Model (Honey 82), the 4MAT Model (McCarthy 87) and the Gregorc Model (Gregorc 82).

<p>Keirsey Temperament Sorter II</p> <ul style="list-style-type: none"> • <i>Guardians</i> are conformity-oriented, and prefer systematic, structured learning • <i>Idealists</i> are interpersonal-oriented, and prefer to learn through discussion • <i>Artisans</i> are play-oriented, and are free-wheeling and creative • <i>Rationals</i> are learning-oriented, and prefer to learn by theorising, analysing and creating models 	<p>The Kolb Model</p> <ul style="list-style-type: none"> • <i>Converging</i> learners like to learn by solving problems and doing technical tasks, good at finding practical uses for ideas • <i>Accommodating</i> learners are people-oriented, hands on learners, who rely on feelings more than logical analysis • <i>Diverging</i> learners prefer to learn by observation, brainstorming and gathering information, are imaginative and sensitive • <i>Assimilating</i> learners prefer to learn by putting information in concise logical order, and using reflective observation 	<p>Hermann Brain Dominance</p> <ul style="list-style-type: none"> • <i>Quadrant B</i> likes to learn in a sequential and organised way, and when instructional exercises are structured and detailed • <i>Quadrant C</i> has an interpersonal preference, is emotional and kinaesthetic. • <i>Quadrant D</i> prefers to takes a holistic approach, is a very innovative learner and is strongly visual • <i>Quadrant A</i> is a factually-oriented learner, takes a logical, analytical, quantitative approach to learning tasks
<p>The Gregorc Model</p> <ul style="list-style-type: none"> • <i>Concrete Sequential</i> are hardworking, conventional learners, who are always dependable and organised • <i>Abstract Random</i> are sensitive, and compassionate learners, who are spontaneous and flexible • <i>Concrete Random</i> are quick, curious and intuitive learners, who combine a creative streak with a realistic outlook • <i>Abstract Sequential</i> are analytical, objective learners, who are thorough, structured and logical 	<p>The 4MAT Model</p> <ul style="list-style-type: none"> • <i>Type 3 (Common Sense Learners)</i> interested in how things work, prefer concrete experiential learning activities • <i>Type 1 (Innovative Learners)</i> interested in personal meaning, prefers co-operative learning, likes brainstorming • <i>Type 4 (Dynamic Learners)</i> interested in self-directed discovery, they rely heavily on their own intuition, like roles-playing and games • <i>Type 2 (Analytic Learners)</i> interested in acquiring facts in order to deepen their understanding of concepts and processes, likes lectures and analysis of data 	<p>The Honey-Mumford Model</p> <ul style="list-style-type: none"> • <i>Pragmatists</i> prefers when the topic under study has an obvious link to the real world, and like to be given immediate opportunities to implement what they have learned • <i>Activists</i> enjoy new experiences and challenges, like teamwork and problem-solving, and enjoy leading discussions • <i>Reflectors</i> prefer to watch, think and ponder on activities, can carry out careful detailed research, and don't like pressure or tight deadlines • <i>Theorists</i> like to learn from models, concepts and theories, like to analyse and evaluate, and use logic

Table 1 – A description and comparison of six four quadrant learning styles models.

From Table 1 it is clear that the models share a great deal in common, particularly in the order they have been presented here and the descriptions used. It is clear that the dimensions of each of these models have strong overlapping characteristics. Indeed it is clear that whereas the dimensions are not exactly the same from model to model, they do have strong equivalencies. It is equally clear that the dimensions in each model do have specific differences. By deriving a learning styles model which omits these specific differences and one which focuses on the commonality it is our hope to create a more general model that will be more inclusive.

5. A Metamodel of Four Quadrant Learning Styles Models: The Gordon-Bull Model

The characteristics which could be considered to form the 'core' dimensions fundamental to all four quadrant models are now presented in a generalised model as follows:

- *Alpha (α) Style* - these are the practical learners, they like to understand how topics being taught relate to the real world. They also like topics which are clearly structured.
- *Beta (β) style* - these are the discussion-oriented learners, they like to work in groups, and derive most benefit from intrapersonal learning.

- *Gamma (γ) style* - these are the holistic learners, they prefer an overview of topic before delving into specific detail. They are also highly imaginative individuals and bring this resource to the learning process.
- *Delta (δ) style* - these are the analytical learners, they are dispassionate learners who like to focus on concepts, theories and logic.

Whereas this may seem to be sufficient to address the possible range of learners, the above model is lacking two aspects without which it cannot be considered a well-rounded model: Resistant Learners, and an Evolutionary View of Learning Styles.

5.1 Resistant Learners

There are very few learning styles models which address a very common type of learner, this is the *Resistant* learner. We feel it is a learning type which is vital to acknowledge if our model is to be successfully implemented in a learning environment. This additional type, the *Resistant* learner, as defined previously in the Martinez Learning Orientations Model is related to, but not the same as the dimension in the Grasha-Riechmann Model (Grasha 95) called *Avoidant*. There are any number of reasons why a learner may not wish to participate in the learning experience, and there are an additional set of complexities which must be considered in relation to an on-line learning environment. Learning with technology can be a challenge and it is important that we distinguish between learners who are having difficulties with the technology and those who are resistant learners for other reasons. Possible reasons why a learner may be unwilling to participate in the learning process in an on-line environment are:

1. they may lack the ICT skills to interact effectively with e-Learning materials,
2. they may lack the self-confidence to use ICTs effectively, or
3. they may not wish to participate in the learning experience because they are apathetic, frustrated, unable, discouraged or disobedient (Martinez 00).

It is reasonably simple to address the difficulties of learners in category 1. A training course in basic ICT skills should alleviate their problems. For learners in category 2, it may be possible to address the confidence problems of some of these learners and allow them to participate effectively in the e-Learning experience using training and confidence building courses. Other learners of this type may be unable to overcome their feelings of fear towards technology. On-line learning will not be an effective means of teaching these learners. Learners in category 3 do not wish to participate in the learning experience for a variety of reasons, as stated above. It may be possible, however, using an on-line environment to encourage these students to overcome their problems. If any of these learners' difficulties can be overcome then they may be re-assessed as an *alpha/beta/gamma/delta style* learner.

It is therefore important to assess the ICT skills of our learners before they begin to engage in on-line learning, and when assessing the learning styles of a particular learner it is vital to also assess their feelings towards technology and their feelings towards learning. If they do not wish to engage with technology, it is important to help empower them to make them feel comfortable enough to effectively immerse themselves in the virtual learning experience. If on the other hand they do not wish to engage in the learning process for other reasons, the learning materials and assessment process must be flexible enough to attract those students who are apathetic and disobedient, and must explain clearly and simply enough for those who are frustrated, unable or discouraged.

5.2 Evolutionary Models of Learning Styles

One of the most oft-repeated criticisms of most learning styles models is the inherent assumption that learning styles do not change over time or with different tasks. Indeed to assume that one must teach a particular learning style to a particular student misses the fact that a given student may be best taught by one method early in learning and by another after the student has gained some competence. To address this, first we recall that there are a family of learning styles models which describe this evolutionary learning process: Lewin's Cycle (Kolb 84), Saljo's Conceptions of Learning (Marton 76), and Bloom's Taxonomy (Bloom 56). It is important that we should consider how this applies to our model.

Every model of learning styles must acknowledge the fact that learning changes over time and with respect to the task being undertaken. With the advent of virtual learning environments it becomes possible to unobtrusively re-assess the learning style of an individual periodically. This facility, which can be programmed into virtual learning environments, addresses one of the key criticisms of learning styles: if they do change over time then it is simply a matter of re-assessing the learner at regular intervals. Similarly to address the criticism associated with learning style changing when undertaking different tasks, it is a matter of using an assessment instrument which is appropriate to the tasks being learned. These assessments can be done in varied and novel ways using the multimedia tools available in an on-line environment. Multimedia can use a combination of several formats including text, video, audio, images, graphics and animation, both to present lessons and to assess learning styles in a number of novel ways. For example, the learner can be presented with lessons in a number of different styles and simply asked which one they prefer or alternatively the on-line environment could automatically log which styles of lesson the learner spends most time interacting with and thus which they prefer.

Courseware such as HTML, Dreamweaver, Flash, XML, ColdFusion, and HyperStudio enable novice computer users to create sophisticated and interactive multimedia presentations. These multimedia presentations are a way in which the needs of a variety of learners can be addressed. The World Wide Web is an excellent model of how educational materials should be developed. It enables materials to be presented in a range of media formats; such as audio or video clips, as textual documents, as images, graphs and diagrams, and allows browsers to assess materials in a format that best suits their particular learning style. Indeed, it is the availability and increased use of web-based materials in traditional and on-line classes that has lead to a renewed interest in the issue of learning styles.

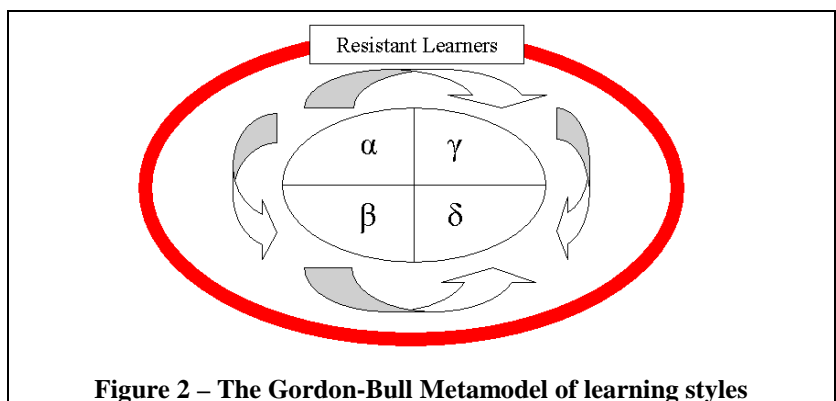


Figure 2 – The Gordon-Bull Metamodel of learning styles

6. Discussion

Learning styles is a controversial topic, and there is little agreement even as to exactly what is a learning style and what is not. If this continues to be the case there will always to be reservations about its usage, which may be denying educators an extremely powerful tool in their arsenal. To ensure consensus exists in the educational research community about learning styles, it is important that a common understanding exists. Keefe's definition of learning style seems to have general consensus, but the fact that it includes the word 'stable' is the source of great controversy. As mentioned previously many educators feel that learning style may not be a stable cognitive attribute in temporal terms and in terms of specific tasks, these concerns can be addressed in an on-line environment, which can be configured to re-evaluate the learning styles, not only at regular intervals, but in a variety of ways using all the modalities possible though the use of multimedia. This problem of stability in learning styles is finally and conclusively addressable through the use of courseware. It is worth noting that not all topics can be taught as successfully through instructional technology as in the traditional classroom and that not all topics can be taught in all learning styles. In the words of Howard Gardner; "there is no point in assuming that every topic can be effectively approached in at least seven ways, and it is a waste of effort and time to attempt to do this."

The other common criticism of learning styles is the fact that it results in the stereotyping or pigeonholing of the learner (Grasha 1990) and is a more complex question to address. It could certainly be addressed through instructional technology where the style of a learner can be assessed and learning materials tailored to that particular

style without the learner ever being aware of their specific learning style, and with the advent of 'clickstreaming' (the software technology that amazon.com uses to configure webpages for individual users) this has become a relatively trivial task. This is certainly one way to avoid stereotyping the learner, by not telling them their learning style, and by not informing the instructor. So in a sense, it is possible to address this criticism through the technology, as with previous criticisms, but whether or not a technological solution to this problem is the best approach is another question entirely. Perhaps what is needed is better education on the topic of learning styles. The better approach to avoid pigeonholing a learner is not by hiding their learning style from them, but rather educating them on what their learning style means and how to use it to their advantage. It is also vital to educate both learner and instructor that learning styles are an evolutionary trait which will naturally change over time. This way learning styles can be of enormous benefit by helping both learners and instructors to think more deeply about their respective roles. For the learner a better knowledge of their learning style can lead to more productive studying. It can help those experiencing academic difficulty cope with their problems by making students aware of their own strengths and preferences. It can also help those who wish to add to their study repertoire. Another vital part of the education of students on learning style should be to help them develop strategies for succeeding in courses taught in ways that are incongruent to their own style.

As with any instrument that assesses mental traits, a learning styles model is imperfect and incomplete, and only measures some learning styles dimensions. Any one instrument will therefore only give an incomplete picture of learning styles. Concomitant with this is the notion that an instructor and/or instructional technology should not force a learner down a specific path to suit their style, but rather should recommend a path for each learner while still allowing them the flexibility to try alternative learning styles materials if they wish to do so. Also even within the recommended path, the instructional technology and/or the instructor should make sure to occasionally recommend something not characteristic with learning style to develop mental flexibility. If we consider Felder's advice again to teach around the cycle and with even four different learning styles dimensions, in a traditional classroom setting this results in each individual learner only being taught in their own style 25% of the time. However using instructional technology where learning materials can be customised to suit individual learners we can teach the learner in their own style for the majority of their learning experience.

7. Conclusions

In this paper we have looked at the question of learning styles, and demonstrated how two models of learning styles can be shown to be equivalent by investigating the dimensions of the models (the Myers-Briggs Type Indicator and the Martinez Learning Orientations Model). From this and the Keirsey Temperament Sorter it becomes clear that there is an alternative categorisation of learning styles models other than the classic Curry 'Onion' Model. Using this approach, and focusing exclusively on four quadrant models, we have distilled a number of 'core' characteristics enumerated in our new metamodel of learning styles. Clearly, there are a number of learning styles models which do not have four dimensions. Based on our approach it becomes possible to classify them as a progressive series of models each one adding more and more dimensions in a logical succession, which will be reported in a forthcoming paper. Finally we have discussed how the use of instructional technology can be employed to circumvent many of the traditional criticisms associated with learning styles.

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