Chapter II

Personalizing Style in Learning:
Activating a Differential Pedagogy

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ABSTRACT

The need to personalize Web-based learning environments on individuals is the main argument of this chapter. The activation of a “differential pedagogy” is proposed, by taking advantage of personalization technologies, in contrast to uniform traditional instructional practices. From the perspective of an educationist, the issue of learner diversity is addressed and discussed, substantiating the notion of individualization in learning. In particular, style is considered as a basic parameter of a new e-pedagogy, in order to applicable reform future educational practices.

INTRODUCTION

A theme running through-out this chapter is the idea of personalizing learning. In the UK, recent Government policy has seen a remodelling of the school workforce and national curriculum. It has in large part taken on what has been described as the transforming reform of an educational system that is now deeply implicated with personalized education and e-technology (Rayner, 2007a; Ritchie & Deakin Crick, 2007). What the UK policy does not consider in any detail is the kind of learning and pedagogy required for personalized education. There is much to do to make best use of emerging new technology and opportunities for using e-learning to support diversity in the classroom. Researchers in the field of e-technology, for example, have increasingly been drawn to the design of adaptive learning systems centring upon the learner, firstly as an individual (Shi, Revithis & Chen, 2002), and secondly when learning in a social context (Naismith, 2005).

Much of the modernizing direction in the research of e-technology, in respect to learning design, echoes previous work in educational psychology (Riding & Rayner, 1995), associated with the advent of an information superhighway and the idea of an individualized learning sys-
tem (ILS). More recent developments, both in advancing the idea of the ILS, as well as other applications for learning design, focus upon the learner, and re-working theories of differential psychology. For example, developments in web-based learning (Graf, 2003; Fiorina et al., 2007), adaptive hypermedia (Brusilovsky & Peylo, 2003; Brusilovsky & Nejdl, 2004), web-based personalization (Germanakos et al., 2007), tutoring systems configured around artificial intelligence (Haykin, 1998, Curilem et al., 2007), learner responses to multi-media and blended e-learning (Ghinea & Chen, 2003; Derntl & Motschnig-Pitrik, 2005; Kimberly, 2007). It is this work which again raises the questions of learner performance and pedagogy: that is, how the learner best learns and most prefers to learn; and how a teacher develops their teaching craft to accommodate the learner.

The intention in this chapter is to examine a relationship between learning styles, individual differences and pedagogy by addressing several particular questions about personal or individual differences in the learner and learning. These questions include firstly asking how teachers can more successfully work in 1) dealing with learning diversity and individual difference – that is – operationalizing the concept of a personalized education; and 2) establishing learning and involving the learner in a pedagogy that seeks the goal of learning mastery – while managing differences in the challenge of developing pedagogic practice.

In considering each of these questions, an account of how the theory of cognitive style and a differential pedagogy can impact upon performance in learning and teaching will be examined. This chapter ends by asking what is likely, by the year 2020, to be the preferred or accepted pedagogic face of instructional design, teaching and learning in a formal educational setting. A response to this last question requires considering the place of an individual learner as a student in a ‘boundedless space for learning and teaching’, as well as the utilization of technologies and media available for developing a ‘post-modern pedagogy for Personalized Education’. This development, in turn, arguably requires work aimed at advancing and re-activating the concepts of personalized learning, e-learning and a differential pedagogy.

INDIVIDUALS LEARNING: THEORY AND PRACTICE

Diversity in the learning community is a very real challenge in any educational context (Rayner, 2007a). It is, however, not only a social phenomenon. McInerney (2005), for example, while pointing to the increasing importance of social psychology and the study of cross-cultural contexts in this area, states that there is less variation between groups than within groups and diversity is a multi-faceted phenomenon. Individual differences, and in particular the psychology of self associated with cognitive style and self reference (Riding and Rayner, 2000; Riding and Rayner, 2001), are acknowledged aspects of personal performance in effective learning and teaching (Prashnig, 1998; Reid, 2005; Rayner, 2007b). The focus in this chapter is personal diversity, and the term is used to refer to a traditional knowledge domain of individual differences and an underpinning theory of differential psychology (Jonassen & Grabowski, 1983; Messick, 1984; Furnham, 2001; Collis & Messick, 2001; Rayner, 2001, 2007b).

A practical beginning for researcher and teacher alike in managing educational diversity is to focus upon individual differences and personal diversity. The following actions provide a basis for better understanding the interaction between learner, learning and teaching and how this might contribute to informing an educational approach to personal diversity in the learning and teaching context:

1. **Understanding the Psychology**: Learner and learning performance
2. **Assessing the Learner, Learning:** Controversy, differentiation and diversity
3. **Personalizing Learning:** Pedagogy, learning theory and ICT
4. **Personalizing Education:** Personal diversity and e-learning

In terms of dealing with diversity, style differences and learning technologies, ‘the teacher’ as mediator is central to enabling effective learning (Weber, 1993), and ‘pedagogy’ is the ‘key’ to successfully mediating the *learning needs* of the student (Rayner, 1998). This should not, however be seen to contradict the goal of learning mastery or independent learning. It is important, furthermore, that the impact of information technology is recognized in this process, not only as a driver for change but also as an opportunity. It is, in fact, an invaluable tool for further developing professional understanding of personal diversity (Laurillard, 2007; Ritchie & Deakin Crick, 2007). Advances too in the field of educational technology will continue to enable alternative research methodologies (De Freitas & Yapp, 2005), as well as reveal new insights into the psychology and construction of personal diversity for the teacher, learner and learning performance.

**Understanding the Psychology: Learner and Learning Performance**

An individual’s performance in learning is influenced by several key constructs in a personal psychology interacting with the learning context (Riding & Rayner, 1998). These include, for example, variables such as personality, intelligence, motivation, self-concept, and cognitive style. This interaction or set of processes is the ‘real stuff of teaching and learning’. It reflects an inter-section of the personal and the social worlds – involving and impacting upon an individual’s state of affect, cognition and ultimately behaviour. Interestingly, a teacher can only ever really be sure of any of this learning process by observing and responding to behaviour. Nonetheless, as teachers or educators work directly with the surface features of performance, reflecting motivation, skills, attitudes and knowledge; they intuitively and continuously work with a ‘beneath the surface’ psychology of self, including a cognitive style, personality, learning preferences, an orientation to study and learning strategies, as well as the key psychological functioning of self reference or regulation as a learner (see Vermunt, 1996; Dunn & Dunn, 1999; Riding & Rayner, 1998; Rayner, 2001; Rayner, 2007b; Zimmerman, 2008). The implications of all of this for education are that a greater awareness of differential psychology in an approach to instruction will yield improved performance for individuals engaged in the formal event of learning and teaching.

Life, teaching and learning, however, is not actually that straight-forward. What is also important at this juncture, consequently, is to acknowledge a deeply contested basis to some of the theory in differential psychology. This is, for example, reflected in a continuing debate around research theory, with recent re-defining and use of constructs such as intelligence (Neisser et al., 1996), abilities (Gardner, 1993) or style differences in cognition and learning (Messick, 1994; Furnham, 2001; Kozhevnikov, 2007). Differential Psychology is by tradition a study of the ways in which individual people differ in their behavior. It is, to date, theory largely reflecting a positivist epistemology and grounded in a ‘classical’ form of empiricism. This intellectual tradition has dominated the field. Research, consequently, has been reliant upon a use of psychometric testing, and statistical controls that are applied to data generated in groups of people. An excellent example of this approach is seen in the early work of Thurstone (1944), who identified stylistic factors across individual perceptual performance. Indeed, Messick (1994:126) describes this research as the first succinct, working formulation of ‘the cognitive-style thesis’ in the field of differential psychology.
Many psychologists, in spite of this controversy, have continued working in a positivist empirical tradition that is claimed to be scientific, in which an interest in the individual’s psychology is pursued by studying groups to identify dimensions or factors shared by all individuals but upon which individuals differ by comparison. For educational researchers, this continuing approach points to a need for cautious and consistent use of psychological tests and theory. For the practicing educationist, it stresses a need to be tentative and deliberate in a choice of psychological model, use of any related measure and an understanding of the theory. What this continuing debate does not justify, however, is an abandonment of differential psychology in the domain of education or psychology. The theory of a differential psychology is undoubtedly work in progress. Indeed, research in the field of e-technology offers a rich opportunity for inter-disciplinary and applied research and a path-way toward a deeper understanding of these constructs with obvious implications for pedagogy, learning and education (see for example Sabry & Baldwin, 2003; Laurillard, 2007).

**Assessing the Learner Learning: Controversy, Differentiation and Diversity**

Models, measures and meaning in the field of individual differences are inextricably linked and to date, are dominated by the development and application of psychometric assessment. To a great extent this reflects the work of proving test validity and reliability using a quantitative methodology. A need to focus upon assessment, however, is also central to learning and teaching as well as any application of differential psychology. Assessment then may have several purposes and take many forms but nonetheless it is an essential ingredient in all learning and teaching. Interest in specifically knowing more about how the learner learns usefully involves developing forms of assessment that profile a learner’s approach to learning (Rayner, 2000). There are, however, dangers in the normative idea of differentiation, including the negative effects of labeling and a pronounced individualism in a general approach to learning. These are reflected in a debate questioning the educational desirability of attempting to develop individualized learning systems or a differentiated curriculum.

Critics of individualization or differentiation have over time re-stated a definition of learning as a social phenomenon, and therefore by implication, argue the need for a social basis to any construction of learning and teaching (Beetham, 2005). Other critics have identified a number of dangers invoked by differential assessment including:

- Its mis-use to predict individual performance causing a constriction of opportunity for the learner, learning and teaching
- Its use as a means of organizing fixed groups of learners according to learner traits.
- Specialization and a restrictive structuring of the curriculum
- The perpetration of social injustice with elitist labelling and regenerating forms of an institutional self-fulfilling prophecy.

Finally, some educationists have completely rejected as perverse the epistemology and ontology underpinning differential psychology. A charge of reductionism, as identified by Ritter (2007), is seen to discredit any attempt at explaining learning and teaching in terms of individual differences. This view perceives such an approach as educationally counter-productive. Ritter (p. 570) argues that research methods and educational practices associated with differential psychology actively 'subvert discourses of diversity and promote commonality'. An epistemological gap is said to exist between pedagogy and psychology. It is described as a philosophical divide, which by inference should not be mediated or indeed cannot be bridged. This means that psychology is, at the least, seen to be an irrelevance for the
educationist or yet more seriously, as a dangerous and illusory distraction facilitating and accommodating authentic diversity in the classroom.

Ritter goes on to identify a conceptual paradox in the psychometric conceptualization of diversity (individual differences), and argues that as a consequence of differential assessment, a dangerous and perverse irony is generated in the use of inventories, measures and tests, facilitating a reductionism and a social control of diversity in the educational setting. A similar critique is presented by Reynolds (1997, p. 122), targeting the research tradition underpinning the development of learning styles. It is criticized for producing an individualized, de-contextualized concept of learning. This epistemology is roundly rejected by Reynolds for producing a ‘depoliticized treatment’ of the learner’s differences, reflecting identity and perhaps more important differences such as social class, race and gender. He argues that psychometric assessment forms a process of reductionist labeling that is not impartial or disinterested as the very idea of types of personal learning style ‘obscures the social bases of difference expressed in the way people approach learning’.

Again, this argument demonstrates the need to be clear as to why and how any form of assessment focusing upon either the learner or learning is used in the design of instruction or construction of a learning system. It is also worth stating, however, that organizing information into categories or sets for making sense of our world is as necessary a part of the human condition—both in terms of a social or personal context—as is establishing commonality in a moral compact when seeking social justice, cultural cohesion, personal accommodation and educational inclusion. The differential perspective, however, is not exclusive nor should it be used to conversely reject the importance of social psychology or sociology, with for example, key constructs such as the learning community, social cognition, identity and mythos, in turn, contributing to our understanding and knowledge of educational diversity. I am, however, at this point, arguing for the necessary place of differential psychology in learning and teaching, reflecting the benefits of awareness in both learner and teacher, as well as the contribution of a personal psychology in an individual’s learning performance. As previously stated, the focus here is with the personal dimension of diversity as it is expressed in the notion of individual differences when it occurs in the learning context.

**Personalizing Learning: Pedagogy, Learning Theory and ICT**

Concern for the learner is part of an approach to using differential psychology and developing a form of ‘best-fit pedagogy’. It is not straight-forward, simple nor an exact science. The DEMOS Working Group, in a useful response to the question what is learning advises us that:

> . . . learning theory does not provide a simple recipe for designing effective learning environments, but there are implications about the design of learning environments. These are characterized as learner-centered, knowledge centered, assessment-centered and community-centered. (DEMOS, 2005, p. 12)

This is exactly the kind of approach to learning and the learner previously described as a basis for personalizing education. The extent to which an awareness of learning style or the self as a learner is focused upon in learning design raises the following priorities in developing pedagogy, including a continuing challenge:

- For the school in an assessment-based approach to learning and teaching
- For subject knowledge leaders managing differentiation within the learning process of the curriculum
- For the teachers engaging with the development and application of a differential pedagogy
For the learner in activity on ‘learning how to learn’ (developing strategies and routines – within and across the curriculum)

For the whole school workforce when planning continuing professional development in the area of individual differences and an inclusive pedagogy

Exploiting learning styles as a teaching device and utilizing differential psychology therefore requires developing a broad-based approach to the ideas of a process curriculum, person-centered learning and an inclusive education. A great deal of theory in a psychology of the self as a learner, regardless of whether it is drawn from the differential, cognitive or humanistic domain, can and should be used to help inform the design of learning and instruction. It is important to locate this theory within a coherent and consistent pedagogic framework that is deliberately linked to the practice of formative assessment (Black & Williams, 2001). This means developing a pedagogic framework that is assessment-led and grounded in process. Assessment, in the form of profiling the learner and the learning process, particularly when using new forms of e-technology, opens up access to meta-levels of cognition and learning in the instructional context (Rayner, 2000).

Differentiation in the curriculum is both about designing and developing new ways of accommodating individual differences in learning as well as facilitating choice-making, decision-taking, adaptivity or flexibility in the learner and the learning environment. This demands a pedagogy that can enable a teacher in meeting the diverse needs of individuals and the group. It requires a ‘proactive approach’ from the school workforce, that is, forming part of an attitude to education predicated upon a person-centered notion of learning (Tomlinson, 1999; Ritchie & Deakin Crick, 2007). The planning and implementation of a differentiated curriculum is not simply a commitment to an individualized learning system (ILS). While e-technology affords considerable advances in developing an ILS, as for example, is reflected in the development of adaptive hypermedia as an alternative to the traditional “one-size-fits-all” approach in learning design, there are also blended learning approaches to group as well as individualized learning systems in the e-learning context (De Freitas & Yapp, 2005). Adaptive hypermedia (AH) systems build a model of the goals, preferences, and knowledge of each individual user, and use of this model for adaptive navigation within an e-learning programme. Personalizing learning and developing a differential pedagogy, however, also involves increasing awareness of ‘learning spaces’ and ‘knowledge communities’ providing an opportunity for collaborative and independent learning (Milner, 2006). This management of the learning group invokes personalizing learning within a social space and place, and in turn can lead to other forms of group-based learning blending with a person-centered and inclusive approach to instruction.

**Personalizing Education: Personal Diversity and E-Learning**

The modernizing agenda for personalizing education is deeply implicated in notions of individual difference and the concept of learning styles. West-Burnham & Coates (2005) link this policy in the UK to a need for re-defining the school curriculum. Their argument is that personalizing learning must encompass a process that is both individual and social, and a curriculum that reflects an integrated consideration for social justice with individual growth and learning. As part of this argument, the authors see the need to ‘take learning styles further’, in the sense of seeking a consensual theory that in a worthwhile way can be safely and securely applied to the learning context. The call for research that will offer a more coherent and consensual theory is not new and it is hoped might be successfully advanced in the contemporary effort to develop e-learning, with new forms of pedagogy suitable for personalizing
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education. It is this intention that reflects recent attempts at defining a ‘differential pedagogy’ as one such new contribution to the practical knowledge of teaching (Rayner, 2007b).

In terms of personal diversity, and in spite of recent criticism (Yates, 2000; Coffield et al, 2004; Ritter, 2007), the intuitive appeal of style differences (cognitive, intellectual and learning) is very popular amongst educational practitioners. It offers a way of explaining and meaningfully understanding individual differences in the classroom (regardless of place or space or virtual reality). It points at potential too for enhancing self-awareness, self-regulation and fostering independence in the learner, as well as providing the educator with a tool for increasing their reference to the individual in the design of instruction and an enhancement of pedagogic knowledge and expertise (Reid, 2005; West-Burnham & Coates, 2005; Ritchie and Deakin-Crick, 2007). The advancements of design in e-learning infrastructure and operation reinforce this exciting potential but at the same time can easily create a technology dazzle obfuscating or even displacing a meaningful pedagogic and educational function (De Freitas & Yapp, 2005).

It is useful nonetheless to turn again to the educational potential of ICT and e-technology as a tool when thinking through the implications of managing personal diversity in the educational setting. Smeets and Mooij (2001, p. 416), in a project for the EU Directorate of General Education and Culture, identified the following key features in pupil-centred learning and curriculum differentiation:

- Teachers act as coaches.
- Learning environments are adapted to the needs, abilities, and interests of individual pupils.
- Pupils are encouraged to be active, cooperate and take more responsibility for the learning processes.
- Teachers pay attention to the potential of ICT to facilitate curriculum differentiation.

Villaverde (2006:197) argues that in order to be effective, e-learning systems should be capable of adapting the content of courses to learner characteristics such as style. In research aimed at improving levels of adaptivity, the potential for modeling of neural networks is demonstrated, offering a system that will automatically recognize the learning preferences of individual students according to the actions that he or she has performed in an e-learning environment. This builds upon earlier development of educational systems exploiting a theory of neural networking and artificial intelligence summarized by Haykin (1998). It is yet a further example of developing forms of an ILS and how differentiated approaches to learning and teaching can be achieved using e-technology. It is, however, not presented as a single approach to learning, or can it nor does it reject the importance of the social dimension and the notion of a learning community.

RE-APPRISING THE USE OF STYLE: A DIFFERENTIAL PEDAGOGY?

Pedagogy is the act and discourse of teaching, and is variously described as a science, a craft and an art form (Mortimore, 1999). Indeed, Galton et al., (1999) follow William James’ original assertion in a series of seminal lectures in 1892 (Talks to Teachers on Psychology and Life), inaugurating the field of educational psychology at Harvard, when claiming that pedagogy is actually a ‘science of art’. Alexander (2001) unfavourably contrasts a contemporary status of pedagogy in English education to a more fully developed ‘science of teaching’ in continental Europe. The latter tradition brings together within the one term, the act of teaching and the body of knowledge, argument and evidence in which it is embedded and by which
particular classroom practices are justified. This means pedagogy is characterized as an integration of distinctive conceptual foci including:

- **Children:** Their characteristics, development and upbringing.
- **Learning:** How it can best be motivated, achieved, identified, assessed and developed.
- **Teaching/instruction:** Its planning, execution and evaluation
- **Curriculum:** The various ways of knowing, understanding, doing, creating, investigating and making sense desirable for children to encounter, and how these are most appropriately translated and structured for teaching.

Further, Alexander’s argument in developing a greater reference to and understanding of pedagogy is apposite in dealing with educational diversity, as is his suggestion that pedagogy generally might also be conceived as comprising several distinctive pedagogies, and how these might contribute to a teacher’s professional development. He uses the example of ‘dialogic teaching’ aimed at:

... incorporating evidence about the nature and advancement of human learning, and to the conditions for education in a democracy, in which the values of individualism, community and collectivism stand in a complex and sometimes tense contrapuntal relationship. (Alexander, 2004b, p. 13).

The implications are that there exist or might be constructed different forms of pedagogy, a combination of which educationists will need to acquire as they develop their own professional pedagogic expertise. Is there, for example, when managing educational diversity and working with individual differences in the learner such a thing as a distinctive pedagogy?

Norwich and Lewis (2001), drawing upon a systematic review to address this question in relation to educational provision for children with special educational needs (SEN), found evidence that teachers attempt to differentiate their teaching according to broad perceptions of pupil ability. They found little evidence to support the idea of teachers adapting or developing an SEN specific pedagogy. They suggested, however, the existence of a ‘high density’ teaching approach that is comprised of a sliding rule or continuum of common ‘pedagogic strategies’. Their review found a trend in research accounts signaling a movement away from ideas of a special needs-specific pedagogy toward an understanding of pedagogy in terms of a ‘general differences’ composition. The import for all of this, Norwich and Lewis argue, is the proposition of further focusing upon individual differences when managing educational diversity, and developing a differential rather than SEN specific pedagogy for inclusive education. They state, for example, that:

More pedagogically relevant groups may be identified in terms of learning process, such as learning styles ... than in terms of the general definitions (for example, MLD, SpLD). (Norwich & Lewis, 2001, p. 325)

Their argument is that learners with different styles of cognition and learning may benefit from specialized or personalized pedagogic strategies that form part of a generalized pedagogy. This is of considerable significance for the application of both a differential and inclusive pedagogy.

This also leads us to another question – what is the scope for developing a differential pedagogy? There are several examples of a deep commitment to the idea of a differential pedagogy linked to the field of learning styles and individual differences (Jonassen & Grabowski, 1993; Riding & Rayner, 1998; Dunn & Dunn, 1999; Reid, 2005). The extent, however, to which the idea of an individualized approach to education has been
explored, debated and passed over during the past fifty years or more points to the paramount importance of a social and pragmatic dimension in learning and education (Coffield et al., 2004). It is also an indication that teachers will invariably resist a prescriptive catch-all in developing modes of pedagogy. Tomlinson makes the very important point that:

Differentiating instruction is not an instructional strategy or a teaching model. It’s a way of thinking about teaching and learning that advocates beginning where individuals are rather than with a prescribed plan of action, which ignores student readiness, interest, and learning profile. It is a way of thinking that challenges how educators typically envision assessment, teaching, learning, classroom roles, use of time, and curriculum. (Tomlinson, 1999, p. 108)

If we wish to take the notion of a differential pedagogy further, it is helpful to begin assembling a working description of such an approach.

The extent to which an awareness of learning style or the self as a learner is currently considered and managed within the educational context raises key issues for the design of instruction and pedagogic practice, including implications for:

- The school: Designing an assessment-based approach focusing upon the inter-relationship between the learner, learning and teaching.
- The subject and pastoral leaders: Creating differentiation within the learning process of the curriculum.
- The teachers: Development of a differential pedagogy building upon the concept of the ‘matching hypothesis’ and ‘style-flexing’ for personal growth.
- The learner: Activity on ‘learning how to learn’ method and strategies and routines – within subject knowledge areas and across the curriculum.
- The use of e-technology and learning theory: in the development of all aspects of a differential pedagogy.
- The school workforce: continuing professional development in the area of extending and developing new and inclusive forms of pedagogy for an increasingly diverse school population.

A practical and useful example of this type of person-centred approach in the classroom is reflected in the work of McCoombs & Miller (2006). It is an integration of humanistic approaches with style-led practices that may very well contribute to developing a differential pedagogy suited to enabling a personalized education. Reid (2005), Mortimore (2003) and Prashnig (1998) amongst others, offer useful summaries of additional practical approaches to developing learning strategies and teaching tactics associated with a style-led approach. Their work provides guidance in the use of some of the building blocks to be applied in constructing a differential pedagogy.

As Laurillard (2007) has suggested, research in education and computer science is now contributing massively to interdisciplinary innovation in teaching and learning. She suggests there is a tipping point in constant motion at the heart of this work. It is framed in the work of developing new forms of learning design and pedagogy. This also reflects a pivotal area in educational research, and as described by Laurillard, it is also set upon a balance tilting from time to time towards technology, offering new flexibilities with a freedom from formality, and then towards education, with its formal organization, reflected in structuring forces of assessment, knowledge, categorization and accreditation. While knowledge and content remain key aspects of instruction, processes of learning, learner differences and formative assessment are the lead foci for a developing model of differential pedagogy, aimed at better managing personal diversity in learning and teaching.
ACTIVATING AN E-PEDAGOGY: ENABLING THE LEARNER

The more recent research and development in web-based learning (WBL) represents only one of several major innovations in the application of information and communication technology (ICT) for learning and teaching (Laurillard, 2007). The focus here, however, is not on a consideration of the design of individualized instruction, which has always interested researchers working with theories of differential psychology (Riding & Rayner, 1995). It is, rather, on how approaches to personalizing learning can build upon this earlier work, say for example, with regard to ILS and WBL. Assessment and profiling the learner’s interests and motivation form a basis for this approach, but should also be integrated with other related social and experiential aspects of the learning process - that is - interaction between the learner and learning (Cox et al., 2003; Germanakos et al., 2007). An ideal scenario for the future is one in which e-technology increasingly provides the means with which to shape an e-pedagogy associated with enabling as well as complementing an emerging differential pedagogy.

Advances in e-technology during the past decade have been quite staggering, opening up opportunities for developing adaptive forms for a personalized learning. This, however, should be seen as a part of and not apart from an inclusive model of learning (Rayner, 2007a). Recent inventions in the technology of WBL support this development, with for example the construction of semantic learning webs, claimed by Sheth et al. (2005), to be a breakthrough for incorporating human perception and pervasive computing in the educational task. A second example of innovative advancement is the more widely established research on adaptive hypermedia, which Brusilovsky and Peylo describes as:

... an alternative to the traditional “one-size-fits-all” approach in the development of hypermedia systems. Adaptive hypermedia (AH) systems build a model of the goals, preferences, and knowledge of each individual user, and use this model throughout the interaction with the user, in order to adapt to the needs of that user. (Brusilovsky and Peylo, 2003, p. 487)

The development of systems and design of ICT architecture aimed at facilitating adaptive and responsive inter-action between user, structural system, inter-face and content in a virtual learning context, generally mirrors other more traditional forms of activity in learning and teaching (see Smeets, 2001; Calcaterra, 2005).

It is, perhaps, important to stress at this point that while these approaches build systems that are conspicuously individualized, a social aspect to learning and the support of social communication and exchange is also an equally conspicuous and recurring feature in emerging e-pedagogy (Moss, 2005; Bilham, 2005; Prinsen et al., 2007). One example of developing a dynamic interactive model for an e-pedagogy was presented in the Palm project (Somekh & Davies, 1991, pp. 156–157). The researchers identified pedagogic change captured in teachers moving from a view of teaching and learning as:

- Discrete, complementary activities to an understanding that teaching and learning are independent aspects of a single activity.
- A sequential to an organic structuring of learning experiences.
- A focus shifting from solely targeting individualized to communicative learning.
- A view of the teacher’s role as an organizer of learning activities to one as a shaper of quality learning experiences.
- A preoccupation with fitting teaching to a group, to a knowledge that teaching needs to be suited to individuals, which calls for continual self-monitoring to manage unintended forms of bias and discrimination.
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- The learning context as confined to the classroom and controlled by the teacher to one of the learning context as a supportive, interactive, whole school culture.
- Technology as either a tutor or a tool to one where it is part of a complex of interactions with learners, sometimes providing ideas, sometimes providing a resource for enquiry, and sometimes supporting creativity.

The pedagogic approaches utilizing ICT adopted by teachers in traditional classrooms can range from only small enhancements of practices using what are essentially traditional methods, to more fundamental changes in their approach to teaching. In any attempt at personalizing learning, implications for a pedagogic framework are that teaching, tutoring, and training must all be primarily concerned with the learning process and the individual learner.

Similarly, the development of learning and tutoring systems in a range of e-technology must be linked to these pedagogic considerations. The ‘conversational framework’ developed by Laurillard et al. (2000) is a helpful example of a template for building such an approach. This framework focuses upon method reflecting the learning process as an interaction between teacher and student(s). It attempts to capture the iterative interactions that must take place for conceptual learning to occur. The framework can be applied at any level of the learning process. These interactions might involve a short dialogue with the teacher explaining something, suggesting a practical example, and commenting on the pupil’s performance, or a much more involved event covering several encounters, class sessions, assignments and debriefing. This, in turn, can be linked to the concept of a multidimensional e-pedagogy as described by Cox et al. (2003), in a research report for the UK Government. The report is emerging as one useful starting point for defining a pedagogic approach to e-learning. This model, capturing a range of issues and features, such as: a realization that teachers’ knowledge, beliefs and values will affect their pedagogical reasoning; and that their view on the power and scope of ICT, its new modes of knowledge representation and therefore the different ways in which pupils may learn, as well as a commitment to the social as well as personalized dimensions of any model of learning, will actually shape the design of learning.

The implications of research and development in e-technology for further developing both an e-pedagogy and a differential pedagogy are illustrated in the following cases: the first is work looking at hypermedia navigation in computerized learning systems; the second work developing a personalization of web-based learning; the third is a study researching the semantic dimension of e-learning; the last is work on pedagogic practice linked to a system of tutoring driven by artificial intelligence.

Case 1: Hypermedia & Cognitive Style

This study (Calcaterra, 2005) explored the effects of learners (N=306), interacting with a hypermedia presentation. The research attempted to measure the impact of learner characteristics (cognitive style, spatial orientation and computer expertise) upon hypertext navigation patterns and learning outcomes. The researchers found that hypermedia navigation behaviour was linked to computer skills rather than to cognitive style and that learning outcomes were unaffected by cognitive style or by computer skills. The study showed, however, that learning outcomes were positively affected by structuring searches to allow for the re-visiting of hypermedia sections and use of overview sections in the early stages of hypermedia browsing. The researchers concluded that the study indicated how individual differences can affect cognitive processing in hypermedia navigation, even though their role is more complex than initially predicted.
Case 2: Personalizing Web-Based Learning

This study (Germanakos et al., 2007) presents a model of web adaptation and a process of personalization that implements a comprehensive user profile. The learning system is therefore built around a model of the learner and an assessment-led pedagogy, in which key learning techniques are identified such as the extraction of user profiles and generation of a comprehensive user profile. These aspects of the learner include visual, cognitive, and emotional processing, which when combined together are found to give an ‘optimized, adapted and personalized outcome’. The value for this and other related systems are arguably foremost in their contribution to multi-channel delivery of web-based content for learning in the educational context and the work-place. A second example is provided by the work reported in a study looking at sequential and global learning style dimensions as they affect the progress of understanding in the learning process (Sabry et al., 2003). These researchers identify three categories of web-based interaction: learner tutor, learner-learner, and learner-information. They explore the way in which the learning preferences of a group of learners are evidenced in these three categories of interaction. Sabry et al. conclude by asserting that an awareness of the pedagogical needs of different learning styles can result in a more effective integrated learning system. Importantly, they also suggest that such improvements to this kind of instructional system will help learners respond more effectively to different learning tasks and support developing a more flexible and autonomous learner.

Case 3: Developing the Semantic Web

This study (Dzbor et al., 2007) offers an alternative but complementary perspective on integrating e-technology, learning and instruction. It focuses upon the idea of a structural fabric in e-technology, and in particular, the ‘semantic web’, to develop an approach that is in effect a service-led, open learning system or e-community, which can incorporate and extend the use of semantic technologies as a means of providing services that are owned and created by learning communities. For example, the researchers show how it is possible to develop a range of educational Semantic Web services, such as interpretation, structure-visualization, support for argumentation, novel forms of content customization, novel mechanisms for aggregating learning material and citation services. This approach provides an example of how an inclusive e-pedagogy should eventually accommodate social as well as personal diversity, in its emergence as a distinct and enabling pedagogic practice. Related work which reflects a broader field of traditional and more recent developments in the field of a semantic web is described by Naeve et al. (2006), in which networking semantic content and engineering ontological frameworks has provided a basis for an integration of both personal and social aspects of educational diversity in a developing model of e-pedagogy. The widening field of semantic design in e-technology is important because of its potential as a basis for ensuring structures and content that capture expression of meaning, ontologies, concepts, levels of inter-operability with information exchange, and finally, the networking of social dimensions in the learning object and the community.

Case 4: Artificial Intelligent Tutor Systems

Curilem et al. (2007), report upon an attempt to identify ways forward in the use of artificial intelligence (AI) for the construction of Intelligent Tutoring Systems (ITS). The work is based on observations of the behaviours of systems in a range of AI applications for an intelligent learning environment. The researchers identify a need for carefully defining e-pedagogy to establish a com-
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A common language between knowledge areas made up from pedagogical, computing and subject-based domains. A mathematical model provides a structural framework for an AI-based system development while integrating these different areas, so that it identifies the elements that constitute the system itself and defines the technological tools to implement it.

This builds upon a new generation of tutoring systems and owes its development to the advances of AI and related cognitive theories on learning, thereby locating the place of pedagogic strategies in a range of simulations modeling knowledge. An interesting example is given by demonstrating how formalization was used to design the adaptive mechanism in an ITS, enabling the adapting of its interface module to pre-selected student characteristics operating in the system. The system is shaped by earlier developments of the ‘didactic ergonomy’ concept (Curilem & De Azevedo, 2003). This model requires that that pedagogic software must be configured so that the interface between user and environment is structured as two axes, the first is an apprentice (learner), and the second is a pedagogic (tutor), axis. The system generates an adaptive and interactive exchange between the apprentice and the learning object being studied.

A second exciting project (Villaverd et al., 2006), looks more closely at the assessment of an individual’s learning style as part of the challenge of personalizing individualized learning systems, so that these are capable of adapting the content of courses to the individual characteristics of students. The method used by these researchers is based on artificial neural networks (ANNs). These are computational models for classification following a theory of the neural structure of the brain. In the proposed approach, feed-forward neural networks are used to recognize students’ learning styles based upon the actions they have performed in an e-learning system. The authors claim that their model is effective and can be used in an adaptive e-learning environment to help in the assessment of students’ learning styles. They also suggest that the same mechanism can be introduced to consider further input actions available in other e-learning systems.

These four cases represent only a small selected sample of a widening field of study. Further research, focusing upon an integration of e-learning, pedagogy and personalized learning, reported by JISC (2007), and De Freitas & Yapp, (2005) respectively, reinforces the argument presented in this chapter, of an emerging model of a multidimensional e-pedagogy as described by Cox et al (2003). As Laurilliard argues, however:

We are still in the early stages of understanding the relationships between technology, pedagogy and education. The technology moves fast, and although the underlying theories of pedagogy are reasonably stable, their instantiation within the context of a formal education system is a complex process. (Laurilliard, 2007, p. 360)

These relationships, in turn, will continue to more broadly affect the pedagogic approaches to design and interpretation of the curriculum and control of learning activity in the classroom. Importantly, in the task of personalizing education, it is also an e-pedagogy that not only can complement but may actually be used to re-activate an emergent model of differential pedagogy.

A WAY FORWARD: PERSONALIZING A 2020 EDUCATION?

The approach to personalizing education in this chapter is about designing a new school experience for the individual learner. It is also about using technological innovation to support systemic renewal in the curriculum. Its aim is to transform learning and teaching. It is, as argued by West-Burnham & Coates (2005), an attempt to re-contextualize education in the modern world of an information society. In a recent review of
style differences research Coffield et al., (2004) vehemently argued for a much greater emphasis upon the study of pedagogy across the field of education. They identified a communication impasse, amounting to a knowledge block existing in all educational research. This situation was strongly criticized for preventing ‘joined-up’ thinking and acting as a barrier to enabling interdisciplinary contributions in an applied domain. They argued that,

*What is needed in the UK now is a theory (or set of theories) of pedagogy for post-16 learning, but this does not exist. What we have instead is a number of different research schools, each with its own language, theories, methods, literature, journals, conferences and advice to practitioners; and these traditions do not so much argue with as ignore each other......* (Coffield et al., 2004, pp. 142-3)

The field of cognitive and learning styles was identified in this review as a worse case scenario, clearly revealing these difficulties for research in an applied discipline. Coffield et al., saw a fundamental contribution to this impasse as the continuing conflict between two key underpinning disciplines in the study of Education, namely psychology and sociology.

*The practical consequence of this divide is two separate literatures on pedagogy which rarely interact with each other. Typically, sociologists and psychologists pass each other by in silence, for all the world like two sets of engineers drilling two parallel tunnels towards the same objective in total ignorance of each other.* Coffield et al. (2004, p. 143)

The need for an inclusive approach to applied research is similarly demonstrated in the cases of e-learning and managing educational diversity. Again, a way forward should reflect distinct advances in research methodology and epistemology for each key constituency, as applied to the field of personalizing education. It will also, however, crucially require the construction of an interdisciplinary and integrative paradigm to inform and support this same work. For applied research to be effective, it must encompass theoretical and practical contexts in the creation, capture and transfer of relevant knowledge. In the same way, there is a need to ensure that the development of pedagogy combines the key contexts of learning, teaching and the curriculum.

A deepening challenge for practitioners and educationists in responding to this way forward is activating a differential pedagogy. To do this involves: 1) dealing with learning differences and personal diversity – that is – exploiting the concept of a personalized education; and 2) establishing deeper understandings of learning process and how ways of engaging the learner can be embedded in a participatory pedagogy when developing pedagogic practice.

The main direction taken here is to call for a more integrated form of research in support of particular professional development. Researchers in the fields of style differences and e-learning are in a good position to lead the way. They should aim to encourage teachers to construct, enable and activate pedagogies that will further support personalizing learning. If this is to impact upon educational practice, there must be a continuing generation and exchange of new knowledge, both academic and applied, across a number of domains relevant to the practical contexts of learning and teaching.

A movement toward creating a consensual theory of learning, teaching and assessment is an underlying premise to the argument in this chapter. This does not mean, as previously stated, that there is one simple menu for learning design, or a single model of psychology to explain the performance of the learner. It is much more likely that none of these approaches will produce easy or simple models of learning, curriculum, instruction and pedagogy. What is necessary, however, is re-
search that can provide a more clearly established framework or script with which to contextualize the ideas, concepts and knowledge used to help understand and improve upon the work of personalizing learning. This should take the form of an inclusive framework, integrating a number of underlying disciplines combining the constituent fields of research and practice in a focused effort to realize pedagogic development.

An agenda for realizing this goal might usefully include reciprocal action in the following three constituent domains: differential psychology, learning theory and e-technology. These domains of knowledge represent a theoretical underpinning for the construction of a dedicated programme of research. The intention is to realize a coherent theory as a framework for supporting and extending the development of personalized learning and a differential pedagogy.

**Differential Psychology and the Learner**

A recurring set of problems identified in this chapter reflect a controversy surrounding definition, structure and validity of a number of core constructs in differential psychology. One example is the debate surrounding ability and intelligence. Attempts to create a more coherent and unified theory of individual differences should build upon the work carried out by an American Association of Psychology task force field which tackled the question of unifying theories of intelligence (Neisser et al., 1996). In terms of style differences and differential psychology, following a similar argument mounted by Messick (1994), work is needed in the re-framing of cognitive styles within a broader personality system. Kozhevnikov (2007) has also argued for theoretically re-integrating the style construct in the traditional model of individual differences. She claimed that this will problematize methodology, stimulating greater understanding of the ‘dynamic systems’ that make up an individual’s cognitive functioning.

The desire for a strategic movement in the field is also reflected in an argument that paradigm shift across this domain should be deliberately targeted (Rayner, 2007c). A combination of research in e-technology and differential psychology is arguably one opportunity for triggering this kind of shift, beginning with evidence-based knowledge exchange, and creating new points of reference for theory building (for example, see Graf et al, 2008). A second opportunity lies with researchers in e-technology and computer sciences following a similar direction as identified by Laurilliard (2007) in her elaboration of a conversational framework for the development of e-learning.

**Cognition, Learning Theory and Instruction**

Mosely and colleagues have identified a great number of theoretical frameworks for thinking and learning that have been used in schooling (Mosley et al., 2005). Their conclusion is that human learning is a complex and multidimensional phenomenon. This is perhaps stating the obvious, but it is useful to take this point as a reference when focusing on any particular aspect of learning theory. It is also a reminder that effective teaching and learning will seek to foster for the learner both individual and social activity. What is perhaps most important for professional development is an opportunity for educationists to further explore and investigate ways of integrating some of these fundamental structures of learning, in actual life, as a scenario that will always involve aspects of the individual interacting with an external world to learn. This re-emphasizes the importance of contextualized research and evidence-based activity located in the real world of applied practice (Rayner, 2007b, c). Similarly, conflicting models of learning theory that are social or personal in origin need to be mediated in an account of the learner learning. This work should be directed to constructing new models of pedagogy as a proper
product of educational research (see Alexander 2004a; Coffield et al., 2004).

**Learning, E-Technology and Pedagogy**

Advances in e-technology remain both a key driver and an end-game in the work of personalizing education. A desire to develop an e-pedagogy is a third and equally important constituent in the work of supporting learning and managing educational diversity. The JISC Newsletter (JISC, 2007) identifies several key actions that are deemed essential in further advancement of an e-pedagogy. These include a consideration of the basic purpose of technology in the learning context and require thinking about:

- **Usability**: Ease of application and efficiency of design.
- **Contextualisation**: Relevance and appropriateness of the technology.
- **Professional learning**: Support for developing expertise, re-conceptualizing learning theories and forming an e-pedagogy.
- **Communities and networking**: Links to issues of social and contextual aspects of learning as well as authenticity and ownership in the work of research and development.
- **Adaptability**: Sustainable and relevant application within context.

The question of purpose, utility and relevance remains the first and final issue for researchers (academic and professional) collaborating in education and computer science.

It is with this purpose in mind that researchers and educationists need to remain aware that technology can create an aura of innovation. It is easy to be dazzled by the enhanced flexibilities and opportunities offered by new sleek and shiny machines for the virtual environments and digital natives of an ‘emailing, browsing ipod generation’. It is this vulnerability for ‘technological tautology’ in the work of computer science that perhaps leads Luarilliard to argue that if we are to discover how to optimize our use of learning technologies, then,

...the focus has to be on pedagogy—what does it take to learn, and how do we help learners in the process? Technology offers a range of different ways of engaging learners in the development of knowledge and skills. Precisely because of the richness of possibilities, we have to be careful not to focus simply on what the technology offers, but rather on what the pedagogy requires. (Luarilliard, 2007, p. 359)

The purpose here then is to construct, extend and continue to refine an e-pedagogy. This is a distinct and particular endeavour but we would argue here that it is best attempted in unison with a similar development of a differential pedagogy.

**CONCLUSION**

It is always important to be clear about the place of research in developing professional knowledge and to be careful in deciding just which theory or perspective shapes working practice. I argue here that a differential pedagogy is not a theory which is a simple, uniform, one-size solution for effective learning and teaching. It offers the idea of a framework for developing approaches to diversity and individual needs in the classroom. In this respect, it is part of an opportunity to build a ‘better-fit’ rather than a ‘perfect pedagogy’. I am, in fact, arguing at this point for retaining the place of differential psychology in an integrated framework of learning theory, teaching and pedagogy. It is vital that teachers are aware of and have a concern for the psychology of an individual’s learning performance. In turn, the forming of an e-pedagogy is an integral contribution to a differential pedagogy and each set of practices will
ideally inform the other in mutual exchange and a reciprocating development.

The over-arching concept that provides a basis for moving toward a consensus model of learning theory as demanded by Coffield et al. (2004) and in turn a re-construction of pedagogy, is personalized education. Fink stated that:

*I think personalised learning is an idea for our time. It’s a recognition of human uniqueness – we are not just trying to turn out assembly-line children. It means redesigning our schools to fit the pupils rather than what we do now, which is to take the kids and force them to fit into the existing structures. It means a focus on learning, deep learning, learning for understanding, learning for meaning and giving people time.* (Fink, 2005, p. 21)

Fink’s assertion is a challenging call to better manage personal diversity in the educational system. It perhaps raises more questions than it actually answers by correctly inferring a resource dilemma posed in the recognition of ‘uniqueness’. Yet, the desire to re-focus upon the process of an individual learner(s), engaging in learning, is a core aspect to a working differential pedagogy.

This chapter began by asking the question, what is likely by the year 2020, to be the preferred pedagogic face of instructional design, teaching and learning in a formal educational setting? The learning endeavour will increasingly be construed as a life-long process. It will more frequently feature the scenario of a ‘boundedless space for learning and teaching’, as well as technologies or media for developing a ‘post-modern pedagogy for Personalized Education’. To further realize this approach in the form of personalized learning, a re-grouping of sets of domain knowledge, and a blending of differential psychology, assessment of the learner and learning, as well as e-technology, are all required. Developing distinctive pedagogies for e-learning and personal diversity in the learning process form a major purpose for this endeavour. Activating and integrating these pedagogies will in turn create new areas of research and an opportunity for improvements to pedagogic knowledge, with a greater chance for realizing positive impacts on young people’s learning and therefore their future.

REFERENCES


