e-Pedagogy: the pedagogies of e-learning

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The aim of this research was to establish effective e-learning practice in higher education. This was achieved by looking at examples of different pedagogic techniques employed in several cases. The effectiveness of these techniques was established by looking at the students' outcomes on these courses. This study has adopted a sequential mixed methodology characterized by an initial phase of qualitative data collection and analysis, which was followed by a phase of quantitative data collection and analysis. The first phase of the study involved collecting a year of data from a postgraduate programme. A grounded approach was used to analyse one million words of online conferences or discussions, and led to the emergence of 29 pedagogic behaviours. These pedagogic behaviours were then developed into a coding instrument. The second phase, hypothetico-deductive analysis, confirmed their presence in three other cases, five million words of online interactions, and established their associations with students' learning and outcomes. The findings suggest seven clusters of pedagogies correlated with students' grades and the effect size calculation revealed an educational significance for all of them. This indicates that if they are employed in online classrooms they are likely to enhance students' learning and outcomes.

Introduction

Despite an increased interest in the use of e-learning to enhance students' learning, it is surprising that so little research has been conducted to justify these claims. Goodyear (2001) concluded: 'the literature on learning in higher education is surprisingly quiet with respect to what both lay people and practitioners might expect to be a key construct—that of "understanding"' (p. 62). Another confirmation was put forward by Spector (2002), who reported: 'the big lesson about technology and learning from the 20th century is that less is known about how people learn than many educational researchers are inclined to admit' (p. xiv). It is therefore critical to find out *how* effective e-learning practices are achieved.

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In their review of 100 published research reports completed in the period 1991–2001, Coomey and Stephenson (2001) found little if any definitive evidence of the overall effectiveness of 'e-learning' compared with more conventional methods. This is not to say that this medium is ineffective but rather to say that there is little systematic and empirical work to show evidence of its evaluation. Laurillard (2002) added that we may not have an established set of characteristic forms of effective e-learning; however, we could identify some effective existing learning activities and produce a model that captures the good practices embedded in the activity regardless of the tool utilized. As a result, if we are to unravel the various components of effective e-learning practice, we need to consider pedagogy. Pedagogies are connected with students' learning and outcomes, and have been widely accepted for epistemological and empirical reasons. In this way, the issue of integrating e-learning into the pedagogical system has recently emerged as an important and pressing focus for research.

While much has been said about the failure of research to provide adequate analytical frameworks for studying e-pedagogy, few researchers have referred to certain practices that promote effective learning. Recommendations in the literature point towards technologies specifically designed to provide interactivity that guides students towards online collaborations (Crook, 1994). This in turn promotes, among other things, skills such as articulation, justification and negotiation (Crook, 1994), shared responsibilities (Laurillard, 1997; Goodyear, 2001), scaffolding (Salmon, 2000), setting hypotheses (Valdez *et al.*, 2000), reflection (Schon, 1992; Laurillard, 1997; Goodyear, 2002), knowledge activation and knowledge application (Gagne, 1965; Bruner, 1997a,b; Goodyear, 2001), individualized learning and motivation (Goodyear 2002; Garcia & Pintrich, 1991, 1993, 1995), goal setting (Schon, 1992; Laurillard, 1993, 1997; Goodyear, 2001; Gagne, 1977), and characteristics such as positive attitude (Mehanna, 2002, 2004), and disposition (Gagne, 1977; Garcia & Pintrich, 1991). All these are produced while students are engaging in cognitive, metacognitive and other learning systems. They have also to be complemented by tutors' strategies such as feedback and reflections (Schon, 1992; Laurillard, 1997).

While the new technologies may eventually lead us to develop a new understanding of effective pedagogies that are specific to these learning contexts, a good place to start is to look for well-established pedagogies that extant research tells us are effective in other teaching and learning contexts and tie in well with students' outcomes. However, a researcher trying to collect facts about what research has found about pedagogy is faced with a daunting task. For example, as cited in Marzano (1998), Hattie *et al.* (1996) identified over 21,000 studies that one would have to consult for a comprehensive literature review on the factors that affect students' outcomes and achievement in education. Looking for effective pedagogies in the meta-analyses research or 'evidenced-based research' that guided educational interventions seems a sensible starting point.

Following an extensive and systematic search of databases, Marzano's (1998) 'A theory-based meta-analysis of research on instructions' was identified as the most

sophisticated and appropriate. It posited the interaction of four aspects or systems of human thought operating in most, if not all situations:

● *The self-system processing of presenting tasks*. This system contains a network of inter-related beliefs that enable one to make sense of the world (Markus & Ruvulo, 1990) and processes that evaluate the importance of the presenting task relative to a system of goals and assesses the probability of success relative to the individual's beliefs. (Harter, 1980; Garcia & Pintrich, 1991, 1993; Garcia, 1995). If the presenting task is judged as important and the rate of success is high, positive affect is generated and the individual is motivated to engage in the presenting task.

● *The use of task-related knowledge*. This system is comprised of the information, mental processes, and psychomotor processes that are specific to a subject matter (Ajzen, 1985; Ajzen & Fishbein, 1977, 1980; Ajzen & Madden, 1986).

● *The cognitive processing of tasks* is responsible for the effective processing of the information essential to the presenting task (Anderson, 1995). This system acts on an individual knowledge base (Lindsay & Norman, 1977) and can be organized in four categories: storage and retrieval, information processing, input/output, and knowledge utilization (Marzano, 1998)

● *The meta-cognitive processing of tasks* controls any and all aspects of the knowledge and the cognitive system (Sternberg, 1977, 1979, 1984, 1986, 1986a, 1986b; Schank & Abeleson, 1977). To this extent, this system has been described as responsible for the 'executive control of all processes' (Flavell, 1979, 1987; Brown, 1978, 1987). In other words, it is the 'engine for learning' (Marzano, 1998).

Figure 1 summarizes Marzano's (2001) learning systems and their connections

From these four systems, Marzano (2001) teased out nine specific pedagogies that were further researched in a separate meta-analysis (Marzano, 2000). Based on their effect sizes (ES) Marzano recommended their use by all teachers in all subject areas. They are:

● Identifying similarities and differences between items (ES = 1.61).

● Summarizing and note taking which involves at least two highly related elements: filling missing parts and translation of information into a synthesized form (ES = 1.00).

● Recognizing effort and providing recognition are strategies that deal with students' attitudes and beliefs and thus, are likely to affect students' level of engagement in cognitive processes (ES = 0.80).

● Homework and practice provide students with opportunities to deepen their understanding and proficiency in any content area (ES = 0.77).

● Nonlinguistic representations involve the use of graphs, charts, maps, mind maps (ES = 0.75).

● Cooperative learning comprises five elements: positive interdependence, face-to-face promotive interaction, individual and group accountability, interpersonal and small group skills, and group processing (ES = 0.73).

● Generating and testing hypotheses involve the application of knowledge (ES = 0.61). For example, a student watches a demonstration on how air flows over the
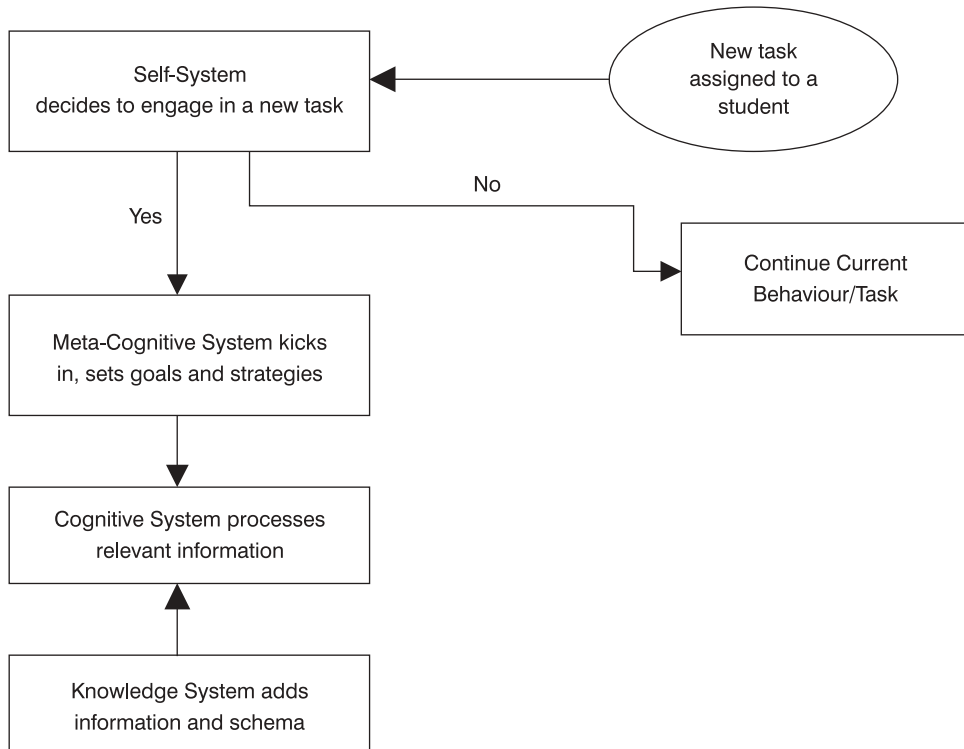
Figure 1.   The four systems of learning and their connections

wing of a plane. Later, he applies this in hypothesizing that the changing shape of wings in a specific way will have a specific effect on the flow of air, designs a wing with desire shape and test his conjecture (Marzano, 1998).

- Setting objectives and providing feedback are activities that many researchers and theorists refer to as the meta-cognitive system of thinking. Both strategies were found to greatly enhance (ES = 0.61).
- Activating Prior Knowledge. The tutor can help students use their background knowledge to learn new information is to present them with advance organizers such as questions and cues (ES = 0.59).

The two meta-analyses provided us with evidence-based research that highlighted specific pedagogies and their association and impact on students' learning. It seems reasonably obvious that e-learning makes use of techniques that have been used effectively in face-to-face learning. However, this study wants the grounded analysis to reveal, in the first instance, the kind of strategies embedded in the online discussions.

Mortimore (1999) refers to pedagogy as a 'contested' term with 'changing connotations and pressures'. His preferred definition states that pedagogy is: 'any conscious action by one person designed to enhance learning in another' (p. 3).

For the purpose of this study, pedagogy is any effective behaviour or activities designed to impart knowledge, it is used in the process of teaching and learning, and has an association with students' learning and outcomes. Of particular interest to many e-learning researchers have been those pedagogies associated with social interactions and online discussions (Henri, 1997; Stephenson, 2002; Alexander & Boud, 2001). Online discussions are facilitated by Computer Conferencing, a web-based communication system that supports asynchronous, textual interaction between two or more persons. Online discussions combine input from tutors and students, and provide opportunities to examine their online interactions, which have been facilitated by the technology. Consequently, a great emphasis was placed on the written communications as they might reveal evidence of students' participation, contribution, communication and work that shows knowledge application, and criticality among other indicators of meaningful and effective learning. Moreover, tutors' input could be monitored for facilitation, feedback and other evidence of effective teaching.

Studies that have analysed the content of the online discussions were also limited. This is due to the time required to perform such analyses (Hara *et al.*, 2000) and researchers still lack a reliable instrument or an analytical framework to analyse the online discussions. Goodyear (2001) noted: 'Analyzing the content of networked learning discussions is a troublesome research area and several commentators have remarked on the difficulty of connecting online texts to discourse to learning' (p. 62).

Methodology

A mixed-modal methodology was adopted using both quantitative and qualitative techniques. Using this approach not only helps answer certain research questions but also facilitates the triangulation within and between stages. Creswell's (2003) model of sequential exploratory procedures fit the purposes of this study. It is characterized by an initial phase of qualitative data collection and analysis, which is followed by a phase of quantitative data collection and analysis. 'Collective case studies' (Stake, 2000) were adopted to investigate several cases which are chosen because it is believed that understanding the collection will lead to understanding and better theorizing of a still larger collection of cases. Four postgraduate programmes in four different UK universities were purposively chosen. 200 students and 14 tutors took part in this study.

The processes of coding and analysis were iterative and started by sorting all online interactions according to individuals' postings. Each student and each tutor had a file. This data was then converted from HTML into text files in order to load it in NViVo.

The first stage of the study adopted a grounded approach. When the data was saturated, the end of phase one of the study had been reached, and stage two began with the development of the code schedule. The content analysis of stage two acted as a wider theoretical sample, for all the categories were re-visited in an attempt to disconfirm or qualify the findings. The researcher went over the transcript sentence by sentence and coded according to the existing twenty-nine categories. Once the coding

was done, a summary sheet was completed for each student and tutor that included the occurrences or frequencies for each one of the pedagogies. Three inter-raters reliability checks were done and their average showed 95.7% agreements. The frequencies of these pedagogies along with students' grades were entered in SPSS for statistical compilations. To unify the measure, all frequencies were rescaled into percentages which facilitated the comparisons between students within the same group and across groups.

For triangulation, online questionnaires and interviews were administered to solicit students' and tutors' accounts with regard to the use of these 29 pedagogic behaviours and their occurrences in the online interactions.

Findings

The first stage of the research consisted of collection of a year of data from a postgraduate programme. A grounded approach was used to analyse one million words of online discussions. Twenty-nine strategies and pedagogic behaviours emerged from students–students and students–tutors interactions. They were categorized into three main groups to form the coding schedule: five common strategies for both students and tutors, thirteen strategies specific to tutors and eleven for students.

The code schedule was then implemented to test the presence of these pedagogic behaviours in three other cases and five million words of online interactions. The text of the online discussions was read sentence by sentence, and coded according to the coding schedule. As a result, the 29 pedagogic behaviours that have emerged from stage one were re-visited, re-interrogated, and re-confirmed in this stage. All categories were present and no new ones have emerged.

Strauss and Corbin (1998) noted that 'axial coding' may be used to relate categories and to continue to develop them in terms of their properties and dimensions until final classifications are reached and we could label the phenomena accordingly. An attempt was therefore made to group the 29 pedagogic behaviours into nine clusters that were theoretically and conceptually tied. The new clusters revealed striking compatibility with Marzano's nine and the 29 categories that emerged from this study provided detailed explanations for each cluster in the form of more specific strategies that could be embedded under each one of Marzano's. In addition to the triangulation achieved in this way, this clustering provided an opportunity to test Marzano's school-based theory in the context of on-line higher education. Table 1 shows the pedagogies, the clusters and their theoretical backing.

Seven clusters correlated with students' grades:

- Summarizing and note taking (with a correlation of r (df = 138) = .287**, $p <$ 0.001).
- Reinforcing Effort and Providing Recognition (with a correlation of r (df = 138) = .181**, $p < 0.02$).
- Homework and practice (with a correlation of r (df = 138) = .487**, $p < 0.001$).
- Non-Linguistic Presentation (with a correlation of r (df = 138) = .151**, p < 0.05).

Table 1.   Clusters, pedagogies and theoretical backing

Clusters according to Marzano's 9	The 29 pedagogic behaviours	Type	Theoretical backing
Identifying similarities and differences	● Comparison and contrast ● Using analogies and metaphors	● Information Processing ● Information Processing	● Cognitive ● Cognitive
Summarizing and note taking	● Summarizing and note taking	● Information Processing	Cognitive
Reinforcing effort and providing recognition	● Tutor giving feedback ● Tutor giving praise ● Student giving feedback ● Student giving praise	● Process Monitoring + Self ● Process Monitoring + Self	● Meta-Cognitive ● Self-System
Homework and practice	● Homework and practice ● Reflections on objectives ● Tutor assign group work ● Students addition to the argument	● Use of knowledge ● Purpose ● Use of knowledge	● Cognitive ● Self-System ● Cognitive
Nonlinguistic representations	● Non-Linguistic Presentation	● Input/Output	Cognitive
Cooperative learning	● Students providing each other feedback ● Students share information ● Students help one another ● Students adding to each other argument ● Students asking questions ● Students recall of previous knowledge/ information ● Tutor assigning group work ● Tutor recall of pervious knowledge/ information ● Tutor addition to the argument ● Tutor addition to the content	● Process monitoring ● Information Processing ● Collaboration ● Use of Knowledge ● Storage and Retrieval ● Storage and Retrieval + ● Use of Knowledge ● Collaboration ● Storage and Retrieval + ● Use of Knowledge ● Disposition Monitoring ● Information Processing	● Metacognitive ● Cognitive ● Metacognitive and self ● Knowledge/ Cognitive ● Cognitive ● Cognitive ● Knowledge/ Cognitive ● Cognitive ● Metacognitive and self ● Cognitive ● Meta-Cognitive ● Cognitive

Table 1.   *Continued*

Clusters according to Marzano's 9	The 29 pedagogic behaviours	Type	Theoretical backing
Setting objectives and providing feedback	● Tutor setting objectives ● Tutor giving directions ● Tutor giving instructions ● Tutor giving updates ● Tutor addition to the content ● Tutor giving students feedback on progress ● Tutor praising students ● Tutor adding to the argument	● Disposition Monitoring ● Process Specification ● Process Specification ● Information Processing ● Information Processing ● Process Monitoring + ● Self ● Self ● Disposition Monitoring	● Meta-Cognitive ● Metacognitive ● Metacognitive ● Cognitive ● Metacognitive ● Metacognitive
Generating and testing hypotheses	● Students setting hypotheses ● Students testing hypotheses	● Disposition Monitoring ● Disposition Monitoring	● Meta-Cognitive
Activating prior knowledge (questions, hints or cues)	● Tutor recall of pervious knowledge/ information ● Tutor giving hints ● Tutor asking questions ● Students recall of previous knowledge/ information	● Storage and Retrieval ● Storage and Retrieval ● Storage and Retrieval ● Storage and Retrieval	● Knowledge ● Cognitive

● Cooperative Learning (with a correlation of r (df = 138) = .375**, p < 0.001).
● Setting Goals and Providing Feedback (with a correlation of r (df = 138) = .328**, p < 0.002).
● Generating and testing hypotheses (with a correlation of r (df = 138) = .431**, p < 0.001).

The total frequencies for all 29 pedagogic behaviours also showed a strong and positive correlation of r (df = 138) = .328**, p < 0.001.

The two clusters (similarities and differences) and (recalling prior knowledge by giving hints and cues) didn't show any correlations with students' grades. Interestingly, this last cluster had had strong and positive correlations with the clusters feedbacks, homework, and cooperative learning which all showed significant correlation with grades. Analysis also revealed that tutors have to be more specific in giving their hints and cues; otherwise students get confused and wouldn't take them into consideration.

Table 2.   Comparison of effect sizes

Small effect sizes	Medium effect sizes	Large effect sizes
Similarities and differences (ES = 0.24)	Cooperative learning (ES = 0.53)	Summarizing and note taking (ES = 0.78)
Recognizing effort and feedback (ES = 0.3)	Setting objectives (ES = 0.50)	Non-linguistic presentations (ES = 0.79)
Generating and testing hypotheses (ES = 0.2)		Homework and practice (ES = 0.83)
		Recall of prior knowledge or the use of questions and cues (ES = 0.76)

Effect Size (ES) calculations were calculated for these nine clusters between two groups and were grouped according to Cohen's (1988) ranking of effect sizes (Table 2, (N = 62)).

Although the effect size calculations provided useful information, it was not the sole basis for making judgement results. The total context of the study was taken into consideration, especially the measures that were used and the scores generated.

Following Cohen's interpretation of ES into percentile standing, the following could be expected as percentile gain from the calculated ES. In other words, the group of students that uses these clusters are likely to have better standing than those students who do not use them (Table 3).

The evidence suggests that these clusters are likely to increase students' grades and it was therefore of interest to analyze the relationship among these clusters and detect if there were any gender difference. School-based gender studies show the boys trail behind girls with their homework and school responsibilities (Sommers, 2000). Sukhnandan *et al.* (2000) even proposed rationales and recommendations to adopt certain

Table 3.   Effect sizes and percentile standing

Pedagogies	Effect size observed Cohen's d	Percentile standing
Similarities and differences	0.24	58
Summarizing and note taking	0.78	79
Reinforcing effort and providing feedback	0.3	62
Homework and practice	0.83	79
Non-lnguistic presentation	0.79	79
Cooperative learning	0.53	69
Setting objectives	0.50	69
Generating and testing hypotheses	0.2	58
Questions and cues	0.76	79

Table 4.   Test statistics[a]

	Summarising & Note Takin	Reinforcing Efforts & Recognition	Homework	Nonling	Cooperative Learning	Setting Objectives & Feedbacks	Hypotheses
Mann-Whitney U	733.500	822.500	720.000	741.500	819.500	861.000	694.500
Wilcoxon W	838.500	8697.500	825.000	8616.500	924.500	8736.000	799.500
Z	−.990	−.367	−1.085	−.971	−.342	−.098	−1.263
Asymp. Sig. (2-tailed)	.322	.713	.278	.331	.732	.922	.206

a. Grouping Variable: GENDER

pedagogic strategies that address gender differences in achievement. Due to the fact that the number of male enrolled in these programmes has drastically surpassed the female, non-parametric tests were conducted (Table 4).

The three tests Mann-Whitney, Wilcoxon and Wald-Wolfowitz showed no significant difference. Therefore, we could firmly conclude that the use of these specific clusters of pedagogies within our context is gender-neutral (Figure 2).

The same was applicable for the two remaining clusters and no difference was found (Figure 3). Therefore the use of e-learning pedagogies within our context appears to be gender-neutral.
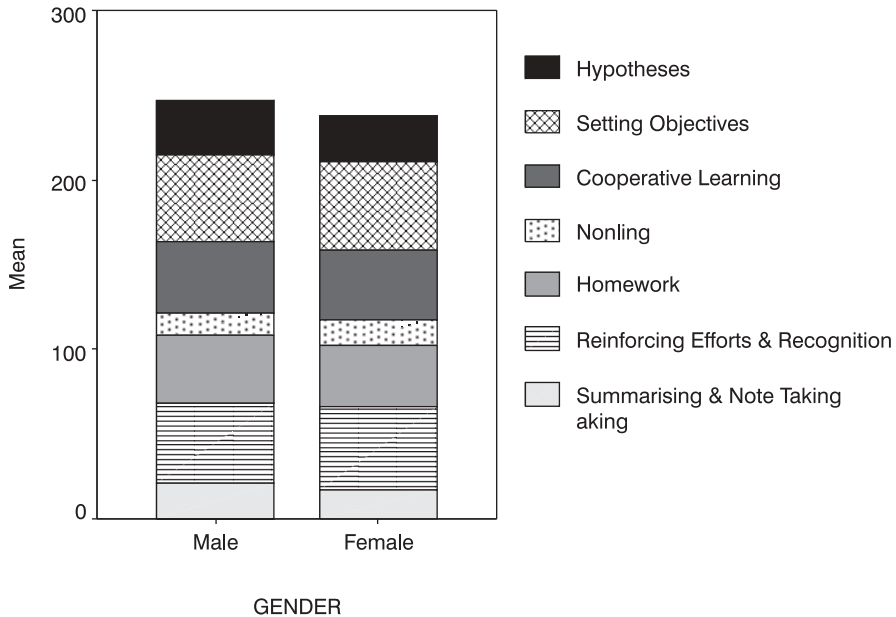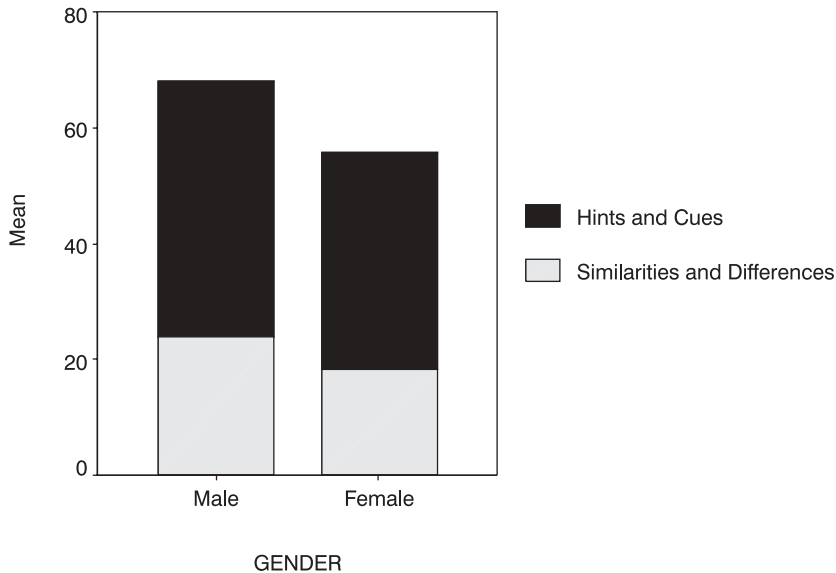

Figure 2.   Gender comparison

Figure 3.   Comparison across genders

Validation of the effect size calculations

Royer (2000) warned: 'It is important to note that measures of effect sizes do not directly translate into indications of practical importance' (p. 239). This warning reinforces earlier work by Glass *et al.* (1981) where they specified that it was not enough to associate the effect-size metric with descriptive adjectives such as 'small, moderate and large'. Therefore, determining the significance of a particular effect size requires interpreting what the size of the effect really means. While recent recommendations (Wainer & Robinson, 2003) were made for the Null Hypothesis (NH) to support the calculation of the effect size and determining its practical importance, it was found that this is not applicable in all cases and several criticisms were apparent due to the misuse and misinterpretation of the NS (Cohen, 1990, 1994; Rosenthal, 1991; Thompson, 1994). An alternative for interpreting the value of ES or its educational significance is 'to think meta-analytically' (Thompson, 2002). Thompson prefers a model where effect sizes from individual studies are interpreted in the context of previous studies, let alone a meta-analysis in our case. This was an additional incentive behind the regrouping of the 29 pedagogic behaviours into Marzano's original 9. The mean and the median indicated non-symmetry in both sets of data, Marzano's and Mehanna's (ES); therefore, the sign test, a binomial test, was found to be the most suitable to seek further comparisons and interpretations (Table 5).

No significant difference was observed. This indicates that the average effect size produced by the different clusters of pedagogies of this study generated almost the same statistical effect reported in Marzano's meta-analysis.

Table 5.   Test statistics[a]

	MEHANNA – MARZANO
Exact Sig. (2-tailed)	.180[b]

[a]Sign test.
[b]Binomial distribution used.

Conclusion and implications

This mixed methods multi-case study research has purposely focused on the pedagogic aspect of e-learning in higher education. Findings suggest a number of pedagogies that are worthy of including in the online teaching and learning processes due to their theoretical backing and the empirical evidence of their correlations with students' learning and outcomes. These emerging nine clusters of pedagogies represent a composite system made of 29 effective practices belonging to four learning systems. These findings provided empirical evidence that 'blending' different learning theories and pedagogies was not only possible but beneficial, and satisfied Oliver's (2004) call to justify the use of 'blended pedagogies'.

The pedagogically driven approach to e-learning allows practitioners to make the link between pedagogy and different learning systems (Conole *et al.*, 2004). This in turn provides empirical evidence that confirms Minocha and Sharp (2004) proposition which denotes that 'e-learning in higher education should adopt pedagogical models that are not *fundamentalist* in nature but allow for a complementarity between behaviourism and constructivism' (p. 2) and cognitivism (Driscoll, 2002). 'One reason for the lack of application of models and theories by e-learning practitioners may be that, as academics outside the field of education, they find the diverse array of theoretical perspectives alien and overwhelming' (Conole *et. al*, 2004, p. 18; McNaught, 2003).

Adopting the effective pedagogies presented in this study seems a first step towards preparing e-pedagogues. An e-pedagogue is a teacher at heart, has a passion for learning, knowledge of learning theories and effective pedagogy, and understands the functionality of e-learning technology.

Acknowledgments

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