The Pedagogies of e-Learning

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ABSTRACT
There is a great need for empirical examinations of e-learning environments and pedagogical assessments of online interactions and discussions. This paper reports part of the findings from a multi-case study that has analysed online conferences of four different postgraduate programmes in four different UK universities. A model of 29 pedagogical behaviours emerged from the one-year grounded analyses and then applied in analysing additional 5 million words of online interactions. The findings suggest four clusters of pedagogies correlated with students' grades; however, the effect size calculation reveals an educational significance for all of them. This indicates if they were to be employed in online classrooms they are likely to enhance students' learning and outcomes.

Keywords
Pedagogies, e-learning, online conferences, learning outcomes, content analysis, coding.

> *"Without appropriate pedagogy, use of high capacity communication services cannot provide significant improvements in learning outcomes. In general it is the pedagogy that provides for learning, not the technology or the software." (Carr, 1999, as quoted in Stephenson 2002, p. 53)*

Technology and pedagogy: how much do we know?

The literature review revealed a struggle to link the potential of online technology with what ideally online education should deliver in terms of students' learning and achievement.

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.

The vast and growing bulk of information now available about e-learning, both in print and online has focused on the potential of technology or the enthusiasm of its users and lacked the pedagogical guidance stemming from research that would inform the processes of online course development, review and moderation. In accordance with this Goodyear (2001) noted: "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" (page 62). Finally, Steeples and Jones (2002) 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" (page xiv).

Technology and pedagogy: how to go?

Boettcher (1997) argued: "Now that the World Wide Web is providing a whole new context for teaching and learning, we have the need to return to the core principles of teaching and learning, and create a new model of teaching and learning." Therefore, if technology is applied in conjunction with pedagogical concepts, it can create an effective student-centered environment and enhance learning outcomes.

The key issue revolve around the nature and the components of effective teaching and learning and is pointing towards establishing the pedagogies of e-learning or e-pedagogy and presenting recommendations for the e-pedagogues. It became more evident that there is a great need for a pedagogical assessment of online conferences and discussions.

This dearth of content analysis is due to the time required to perform such analyses (Hara, Bonk and Angeli, 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" (Page 62).

Theoretical framework for the content analysis of online classrooms discussions

The need for specific and comprehensive categories with which to organise the research on online pedagogy materialized as a must and the analysis or the coding of online discussions needs to be developed to show evidence of effective pedagogies.

While the new technologies eventually may lead us to develop new understanding of effective pedagogy that are specific to these learning context, perhaps 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 are well tied 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, Biggs and Purdie (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. Therefore, looking for effective pedagogies in the meta-analyses research seems a sensible starting point.

This research has therefore built on Marzano's (1998) meta-analysis which empirically tested nine pedagogical strategies with effect sizes (ES) "showing evidence of their effectiveness in enhancing students' achievement for all students in all subject areas at all levels" (*Op Cit*, page 4)

His theory-based meta-analysis posited the interaction of four aspects or systems of human thought operating in most, if not all situations. Those systems are:

- The self-system processing of presenting tasks. This system contains a network of interrelated beliefs that enable one to make sense of the world (Markus and 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 and Pintrich, 1991, 1993, 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 and Fishbein, 1977, 1980; Ajzen and 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 and Norman, 1977) and can be organised in four categories: storage and retrieval, information processing, input/output, and knowledge utilisation (Marzano, 1998)
- The meta-cognitive processing of tasks controls any and all aspects of the knowledge and the cognitive system (Sternberg, 1977, 1984a, 1984b, 1986a, 1986b; Schank and Abeleson, 1977). To this extent, this system has been described as responsible for the "executive control of all processes" (Flavell, 1979, 1987; Brown, 1978, 1980). In other words, it is the "engine for learning" (Marzano,1998)

From those four systems, Marzano (1998) teased out nine specific pedagogies that were further researched in a separate meta-analysis (Marzano, 2000). Based on their effect sizes Marzano recommended their use by all teachers in all subject areas. They are:

- Identifying similarities and differences between items. (ES = 1.61)
- Summarising and note taking which involves at least two highly related elements: filling missing parts and translation of information into a synthesised form. (ES = 1.00)
- Reinforcing 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 = .80)
- Homework and practice provide students with opportunities to deepen their understanding and proficiency in any content area. (ES = .77)
- Nonlinguistic representations involve the use of graphs, charts, maps, mind maps. (ES = .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 = .73)
- Generating and testing hypotheses involve the application of knowledge. (ES = .61)

For example, a student watches a demonstration on how air flows over the wing of a plane. Later, he applies this in hypothesing 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 = .61)
- Activating Prior Knowledge. The tutor can help students use their background knowledge to learn new information is to present them with advance organisers such as questions and cues (ES = .59)

Although, the effect sizes of Marzano's pedagogies strongly correlated with students' learning and improvement, it was found that they were initially too broad to capture the subtleties of pedagogic activities.

Using a grounded approach in the analysis of one million words or an academic year of online discussions, twenty-nine more specific pedagogic behaviours have emerged to encompass all the online interactions and were categorised into three distinct groups to form a coding schedule or a Model for Analysing the Pedagogical Content of Online Discussions (MAPCOD).[33] This model includes:

- 5 common pedagogic behaviours that could be used both by students and by tutors.
- 16 pedagogic behaviours used by students
- 18 pedagogic behaviours used by tutors

For added rigour, this model was used in the analysis of 11 classes of three different postgraduate programmes, represented by 11 tutors, 160 students and a totality of 4,924,197 words of online discussions. Evidence of all existing categories was there and no new categories have emerged. This has satisfied the saturation required by the grounded theory.

Data preparation and coding

The whole process of coding and analysis was iterative and it 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 researcher went over the transcript sentence by sentence and coded according to the existing 29 categories. Sometimes it was noticeable that one sentence could have double coding and overlapped between two categories.

Once the coding was done. Each student and tutor had a summary sheet that included the occurrences or frequencies for each one the pedagogies. Inter-raters reliability checks showed 97% agreements.

The frequencies of those 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 those 29 pedagogic behaviours and their frequency within their online interactions.

Statistical Findings

Correlations were calculated for each student's grade and the total frequencies or Σ of the 29 pedagogic behaviours employed in his/her entire work as well as those contributed by the tutor. Strong and significant correlation ($r = .328^{**}$ and $p < .0001$) was observed.

Later, the 29 categories were re-grouped into 9 clusters to fit in Marzano's original pedagogies and their effect size has been calculated[34]. This regrouping was done to test Marzano's theory that they work for all classrooms and all age groups. Although, four clusters correlated with students' grades, the effect size (ES) for each cluster of pedagogies showed evidence of educational significance. According to Cohen's (1998) classification of ES,

- 5 pedagogic behaviours ranked as small. They are:

[33] Appendix 1

[34] Appendix 2 shows the theoretical link of those 29 categories, the re-grouping into 9 clusters and their effect sizes.

a) Similarities and differences (for example, all utterances in which Tutor and/or Students analyse two or more elements in terms of their similarities and differences) ES = 0.24

b) Recognising efforts (Utterances where tutor gives feedback on students' progress or presented work, praising students' work and when students give feedback to colleague's work and when they also praise their colleagues' work) ES = 0.2

c) Cooperative Learning (Utterances where tutors assign group work, students share note and ideas, ask questions or request help, help each other, add to one another arguments, also when tutor interjects and adds to the argument or to the content of the topic under study, and evidence or recalling prior knowledge) ES = 0.3

d) Setting objectives and feedback (Utterances where tutor sets objectives, gives directions ,instructions and or updates to reach that objectives, help students with the content, adds to their arguments and gives feedback and/or praise to work) ES = 0.34

e) Generating and testing hypotheses. (Refers to all utterances where students show evidence of setting and generating hypotheses, presenting ideas and/or arguments and where students show evidence of defending an argument set earlier and being justified) ES = 0.2

- Tow pedagogic behaviours ranked as medium. They are:

  a) Summarising and note taking (Utterances in which Students collect, review and summarise notes or re-present them after an analysis to decide what is most important to be included) ES = 0.62

  b) Homework and practice (Utterances providing evidence of Homework and practice. This could be identified as students' presenting assignments and applying knowledge in their work) ES = 0.73

- Two pedagogic behaviours ranked as large with an ES > 1. They are:

  a) Nonlinguistic presentations (Utterances were students show evidence or presenting their ideas in a non-linguistic form. Graphs, charts, tables, maps, illustrations, etc) ES = 1.08

  b) Questions and cues (Utterances where tutors use questioning to help students activate their prior knowledge and by also providing students with help or feedback in the form of questions hints and cues) ES = 1.01

Determining the significance of a particular effect size requires interpreting what the size of the effect really means. While recent recommendations (Wainer and Robinson, 2003) were made that the Null Hypothesis (NH) could support the calculation of the effect size in 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, 2002b).

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 reason behind the regrouping of the 29 pedagogic behaviours into Marzano's original 9. Comparisons of ES can be easily made in appendix 2.

Further correlations were sought for each cluster of pedagogies and individual students' grades.

The following was observed:

- Summarising and note taking had a strong and significant correlation of r = .204* and p < .001
- Homework and practice had a strong and significant correlation of r=.371**and p < .0001
- Cooperative learning had a strong and significant correlation of r =.260 **and p < .002
- Generating and testing hypotheses had a strong and significant correlation of r = .279 **and p < .001

CONCLUSION AND IMPLICATIONS

The research has purposely focused on the pedagogic aspect of e-learning in higher education and a "Model for Analysing the Pedagogical Content of Online Discussions (MAPCOD)" has emerged as a reliable tool that could be implemented in the content analysis of online discussions and could provide guidance to e-pedagogues and course designers.

Findings suggest a number of pedagogies that are worthy of including in the online teaching and learning processes due to their theoretical and empirical backing and link with established learning systems.

Empirical evidence of their correlations with students' learning and outcomes perhaps would encourage online tutors to adopt the proposed pedagogies and use the devised model as a blue print for analysing the content of their course part of an action research in order to enhance the quality of their courses.

Appendix 1: Model for Analysing the Pedagogical Content of Online Discussions (MAPCOD)

No.	Code	Pedagogic behaviour	Definition for Each Category
1	**SumNote**	Summarising notes and note taking and/or summarising ideas	Refers to all utterances in which Tutor and/or Students collect, review and summarise notes or re-present them after an analysis to decide what is most important to be included.
2	**CompTrst**	Identifying similarities and differences (comparing and contrasting)	Refers to all utterances in which Tutor and/or Students analyse two or more elements in terms of their similarities and differences
3	**Metafors**	Identifying similarities and differences (using analogies & metaphors)	Refers to all utterances in which Tutor and/or Students analyse two or more elements in terms of their similarities and differences however by creating metaphors and analogies to present them.
4	**HWPract**	Practice & application of knowledge in Homework.	Refers to all utterances providing evidence of Homework and practice. This could be identified as students' presenting assignments and applying knowledge in their work
5	**Nonling**	Non-linguistic Presentations	Refers to all utterances were students show evidence or presenting their ideas in a non-linguistic form. Graphs, charts, tables, maps, illustrations, etc are looked for.
		Students	
6	**Stobject**	Students setting objectives	Refers to all utterances where there is evidence of students setting their own learning and course objectives.
7	**Mtobject**	Students meeting objectives	Refers to all utterances where there is evidence of students meeting set objectives. Those objectives could be their own objectives as well as course objectives.
8	**St-share**	Students share notes	Refers to all utterances where there is evidence of students exchanging notes and sharing information.
9	**Stfeedbk**	Students share feedback	Refers to all utterances where there is evidence of students responding to colleagues' messages/posting either by agreeing with what has been said, praise, or any relevant comments about their colleagues' work and posting.
10	**Sthelpst**	Students on this course help each other (directions)	Refers to all utterances where there is evidence of students helping each other. This help could be in the form of answering questions, guiding or facilitating the execution of a task.
11	**Hyposet**	Students setting hypotheses/presenting arguments	Refers to all utterances where students show evidence of setting and generating hypotheses, presenting ideas and/or arguments.
12	**Hypotst**	Students testing hypotheses/justifying arguments	Refers to all utterances where students show evidence of defending an argument set earlier and is being justified.
13	**Stargue**	Students building/adding one each other argument	Refers to all utterances where there is evidence displayed that students are building on each other arguments.
14	**Stquest**	Students asking questions	Refers to all utterances where there is evidence of students are asking questions. Those questions could be for clarification purposes, or for asking 'how to do' or 'what to do', etc. and they could be addressed to tutor and peers.
15	**Strecall**	Students recall of prior knowledge	Refers to all utterances where there is evidence of students recall on prior knowledge. It could be in the

		knowledge	form of summarising points of previous posted messages or referring each other to a concept or an idea taught and/or discussed earlier.
16	**Stpraise**	Students providing recognition	Refers to all utterances where there is evidence that the students' feedback to each other is showing statements of praise and encouragement such as 'well done', 'very good', 'good work', etc.
		TUTORS	
17	**T-quest**	Tutors asking questions	Refers to all utterances where there is evidence the tutor is asking questions.
18	**T-direct**	Tutor giving directions	Refers to all utterances where there is evidence the tutor is telling students 'how to do' things that facilitate their tasks, assignments and learning.
19	**T-instr**	Tutor giving instructions	Refers to all utterances where there is evidence the tutor is telling students 'what to do' ie, assignments, deadlines, rules of posting, group work.
20	**T-hints**	Tutor gives hints and cues	Refers to all utterances where there is evidence the tutor feedback to students about is in the form of hints and cues which facilitate students' completion of tasks and/or understanding concepts.
21	**T-recall**	Tutor calling upon prior knowledge	Refers to all utterances where there is evidence the tutor is calling upon students' prior knowledge. They could be ideas, concepts, theories, events and any curricular material and information with a view to stimulating recall of students.
22	**T-feedbk**	Tutor feedback on progress reinforcing effort.	Refers to all utterances where there is evidence that the tutor's feedback is showing statements acknowledging students' efforts and capabilities in achieving tasks.
23	**T-praise**	Tutor providing recognition	Refers to all utterances where there is evidence that the tutor's feedback is showing statements of encouragement and praise such as 'well done', 'very good', 'good work', etc.
24	**T-contnt**	Tutor's addition to content	Refers to all utterances where there is evidence that the tutor's feedback is in the form of further addition and or clarification to the course content.
25	**T-expln**	Tutor explains purpose of module, work requirements. Or clarifying relevant students' questions	Refers to all utterances where there is evidence that the tutor has clear explanations of the course material, requirements and expectations and also clarifying students' questions.
26	**T-set-obj**	Tutor sets objectives for students	Refers to all utterances where there is evidence that the tutor's feedback is showing statements setting further learning objectives for students. These objectives could be individual (addressed to one student) as well as collective (addressed to members of one group).
27	**T-updates**	Tutor announces updates	Refers to all utterances where there is evidence that the tutor keep students posted with any relevant updates. i.e, changes in schedule, changes in dead lines, as well as her/his availability.
28	**Tasgnwrk**	Tutor assigns groups & work	Refers to all utterances where there is evidence that the tutor assigns students' groups (collaborative work) where students are expected to meet common objectives. ie, a project, an assignment, group report, etc.
29	**T-addarg**	Tutor builds/adds to students argument	Refers to all utterances where there is evidence that the tutor's feedback is showing statements that builds on students' arguments.

Appendix 2: Theoretical Links of the Pedagogies and their Effect Size

Marzano's Pedagogies	**Categories of the developed model (MAPCOD)**	**Type**	**Theoretical Backing**	**Cohen' s *d* From Marzano's meta-analysis**	**Cohen' s *d* Observed in this study**
Similarities and Differences	• Comptrst • Metafors	• Information Processing • Info. Processing	• Cognitive • Cognitive	1.61	0.24
Summarising and Note Taking	• SumNote	Information Processing	Cognitive	1.00	0.62
Reinforcing Effort and Providing recognition	• T-feedbk • T-praise • Stfeedbk • Stpraise	Process Monitoring + Self Process Monitoring + Self Self	• Meta-Cognitive • Self-System	.80	0.2
Homework and Practice	• HWPract • Mtobject • Stargue	• Use of Knowledge • Purpose • Use of Knowledge	• Cognitive • Self-System • Cognitive	.77	0.73
Non-Linguistic Presentation	• Nonling	Input/Output	Cognitive	.75	1.08
Cooperative Learning	• Stfeedbk • St-share • Sthelpst • Stargue • Stquest • St-recall • T-asgnwrk • T-recall • Taddarg • Tcontnt	• 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 • Cognitive • Cognitive • Cognitive • Cognitive • Metacognitive and self • Cognitive	.73	0.3
Setting Objectives and providing feedback	• T-set-obj • T-direct • T-instr • T-updates • T-contnt • T-feedbk • T-praise • T-addarg	• Disposition Monitoring • Process Specification • Process Specification • Information Processing • Information Processing • Process Monitoring + Self • Self • Disposition Monitoring	• Cognitive • Metacognitive • Metacognitive • Cognitive • Metacognitive • Metacognitive	.61	0.34
Generating and Testing Hypotheses	• Hyposet • Hypotst	• Disposition Monitoring • Disposition Monitoring	Meta-Cognitive	.61	0.2
Activating Prior Knowledge: Questions and Cues	• T-recall • T-hints • Tquest	• Storage and Retrieval • Storage and Retrieval • Storage and Retrieval	Cognitive	.59	1.009

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