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The Cone of Learning: A Tertiary Level Empirical Study across Traditional, Blended and Flexible Learning Modes

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THE CONE OF LEARNING: A TERTIARY LEVEL EMPIRICAL STUDY ACROSS TRADITIONAL, BLENDED, AND FLEXIBLE LEARNING MODES

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Abstract

Tertiary institutions are moving towards more flexible teaching and learning environments. Relationships between tertiary teaching and learning modes, student outcomes, and learning perceptions have engaged partial studies. This article employs a holistic view. It develops and tests a tertiary teaching and learning environment from a value enhancement approach. Here student-preferred teaching and learning modes are assessed. The tertiary institution teaching and learning offerings or modes are mapped against student learning outcomes, as defined by the tertiary institution 'business enhancement measurement model'. This research shows tertiary institutions can more closely align their educational teaching and learning solutions towards their student's perceived learning requirements, whilst also enhancing its student's skills.

Keywords: Learning modes, tertiary, education, flexible, blended, traditional. student outcomes, student perception

Introduction

Tertiary institutions educate and proactively instruct learners to acquire high levels of knowledge and skills. They up-skill and train students deploying: (1) enhancement, implementation and impact measures; (2) learning assimilation enhancement processes; and (3) diagnosing impediments successful learning enhancements [2][3] and deliver learning enhanced student solutions [29]. These learning improvement cycles operate in a similar manner to business 'plan-do-check-act' quality cycles [41][14][16]. Thus, both the product and/or quality of the service are engaged, student knowledge application solutions are continually revamped, and best student learning options are sought for each student cohort [46][48][18].

Closely aligned, tertiary institution knowledge-application solutions [22][23][24] may capture combinations of traditional, blended or flexible learning modes [13][20]. These in-turn, may affect performance outcomes of the students. These measures (capturing teaching and learning effectiveness) are related to the student learning processes. Quality tertiary teaching and learning institutions aim to balance their tight budgets, meet student expectations and deliver targeted, business-acceptable graduate solutions [39].

Tertiary teaching and learning modes remain an issue for tertiary education institutions and for their engaging students [15]. They are also an issue for tertiary staff grappling with the demands of workload, research, and administration whilst also targeting their lecturing delivery of high quality programs [42] and are often executed within the confines of tight departmental funding, institutional streamlining and budgetary constraints [39].

Tertiary students outcomes are built on: (1) their acquired skills and outcomes – captured as their: interpersonal, informational, analytical and behavioural components [8]; (2) their perceived learning like: satisfaction, experiences, value and quality [43][31]; and (3) their student perceived satisfaction transitions towards their employment future and/or perceived business related workplace successes. Students see their potential tertiary outcomes as both workplace performance services and acquired value-adding services for their chosen future workplace destinations [32]. Students expect to emerge from tertiary institutions with skills sets: capable of reasoned thought; reliable and critically appraised research; ideas transposition, skills and knowledge adaptation, strong interpersonal skills [12][33]. They expect the tertiary institution to equip them with skills relevant to their future agile and flexible workplace environments [5][9][11].

In the global workplace, flexibility offers a pathway towards delivering appropriate responses to customer generated requests [50]. Pine, Bart & Boynton [3] suggest a business with customised offerings can better target its customer's need and preferences (and at customer acceptable price settings). Zipkin [50], adds that technology-enhanced, customer-integrated business solutions jointly capturing combined effects from: (1) customer connection; (2) process flexibility; and (3) logistics, can add value to the customer generated solution – and do so in a cost efficient manner. Ansari and Mela [1] add that visually pleasing web-based solutions, built on intelligently-tapped digital sources, and downstream business network capabilities, can be

selectively programmed towards specific customized solutions. Such selectively programmed, web-connected processes, can deliver, in near real-time, a chosen customised business solution to the customer Murthi and Sarkar [38]. The capturing of individual customer, web-connected data, in near real time, may enable the delivery of targeted customer solutions. This customer-specific process is termed 'personalization' [38]. But, personalisation may also be more complex, and may require special networked technologies. Hamilton and Selen [27] show technology-networked solutions, built stepwise, from the customer engaging front-end into the business's networked back-end systems, and tapped intelligently to track customer shifts, can even more closely align the business and it is offerings towards each customer's specific requirements. They term this arrangement 'customerisation' – where one business ideally provides a solution to just one customer each time. Tam and Ho [45], and Jackson [30] suggest digital content and knowledge-requested services when targeted to individual customers, move the customerisation processes closer to reality. Thirumalai and Sinha [47] show customisation (or customerisation) may be split into stages as a customer three step process. They suggest there is: (1) a decision to engage stage, then: (2) a service and/or product selection stage, and finally: (3) a transaction stage, completes the process. Thus, to better engage with the customer, the business may adopt a 'more flexible' approach towards its delivery modes.

Today, intelligently-networked, changeable, business-delivery modes, along with their generated customer engagement perceptions, can intelligently programmed into business front-end business-customer interface solutions [23]. These approaches mean the modern business can trend towards offering greater flexibility and value adding in its attempts to best answer each customer's enquiry. Hence, a tertiary education business (with students as its customers) may follow similar customerising pathways, as it seeks to more closely emulate such emerging flexible and agile business approaches.

Tertiary Teaching and Learning Modes

In the tertiary education environments, Collis and Moonen [11] map degrees of flexibility, and the goal of learning activities into four quadrants. Quadrant one resembles traditional teaching and learning. It typically occurs in a teacher-directed environment, with instructor-to-student(s) interactions occurring in live, synchronous-rich, face-to-face learning environments [36][34] [5][7][19].

Quadrant two captures a form of blended learning termed blended enhanced learning. Blended enhanced learning encapsulates 'the what', 'the where', and 'the when' of learning [28], and may be defined as 'a combination of instructional media or learning systems that combine face-to-face instructions with computer assisted learning management systems' [4][7][9][20][49]. Blended enabled learning is primarily focused on delivering additional flexibility to the students, whilst providing similar, but different learning components or learning opportunities more in line with agreed student desired and educator accepted outcomes. Thus, personal and/or team-based, student-centered, real-world learning materials, relevant to the learning focus, may be added to the learning offerings, but they are still tied to aspects of teacher-lead traditional learning mode frameworks. Here, a traditional learning environment is typically supplemented by on-line, or computer-mediated, learning elements and/or technology-equipped virtual classrooms engaging the student with learning experience extensions like discussion boards, social networks, gaming environments, personal blogs, and virtual teams.

Quadrant three approaches may involve contributions to the professional tertiary learning environment from both the students and the various instructor teams. Overall, more personally engaging activities are experienced by each student. A range of student-centered learning activities are engaged to increase the richness of learning. For example, (1) role plays; (2) case studies presentations; (3) problem solving activities; (4) instructor podcasts and simulations; and (5) web-located teaching support materials may be included.

Quadrant four portrays a flexible learning environment. Here, instructors are directly involved in the planning, monitoring and setting of each individual student's learning quality, value, skills, controls, and satisfaction issues. This one-on-one style curriculum between the provider and the learner has been termed a 'customerised' service provision [22]. This often unique, negotiated and pre-agreed unique learning framework allows for a radical transformation of pedagogies. Flexible learning moves the learning dimension from a model where learners are just receivers of information, to a model where learners actively construct learning and knowledge. The dynamic interactions within this learning environment enable intellectual activities which may be transformed through technology [7]. For example, students engaging in intellectual discussions through collaborative learning modes like

discussion boards and wikis may transform individual ideas and research into shared knowledge.

Biggs [6], Bonk and Graham [7], Cybinski and Selvananthan [13], Michinov and Michinov [35], Georgouli, Skalkidis & Guerreiro [20], Hamilton and Tee [25][26] have shown the four teaching and learning modes (face-to-face, blended-enabled, blended-enhanced or flexible) established above, show differences in their learning and engagement approaches, and these relate to student learning forming a 'Cone of Learning' continuum [26]. This 'Cone of Learning' continuum, built on the student learning areas of the Biggs [6] 3P teaching and learning model, is shown as Figure 1.

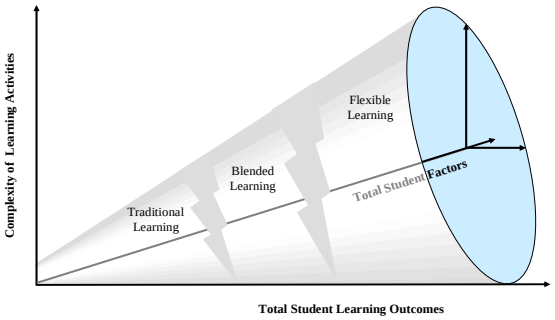

Figure 1: The Cone of Learning, Hamilton and Tee [26].

It portrays increasing complexity in the resultant learning mode offerings options - as more activities (like participation in and the level of learning experiences required) are engaged in conjunction with inherent student factors (like the personal learning skills set brought by the student), and whilst delivering optimal student learning outcomes options (like acquired student learning skills and optimal acquired quality of student learning). Thus, as one progresses from the face-to-face base level (or traditional learning mode approaches) towards the more complex flexible learning mode approaches, far greater total student learning outcomes effects are projected shown to be delivered [26].

At the flexible learning end of the 'Cone of Learning' complex mixes of timing and flexibility; content and flexibility; entry requirements; instructional and resources deployment approaches, and delivery and logistics [11] , along with the delivery of: the 'what', the 'where', the 'when', the 'how' and aspects of the 'why' associated with the learning processes may be engaged as potential contributors to the student learning processes [25].

The 'Cone of Learning' also displays blurred boundaries between different teaching and learning modes. Michinov and Michinov [35] support the blurring of boundaries between the face-to-face and blended teaching and learning modes, and Georgouli, Skalkidis, and Guerreiro [20] indicate a similar situation between blended and flexible teaching and learning modes. This paper adds another dimension to Hamilton and Tee's [26] 'Cone of Learning' continuum by expanding the blended section into a lower-level or blended-enabled mode and a higher-level or blended-enhanced mode, again with blurred boundaries. This reconstruction of the 'Cone of Learning' is portrayed as Figure 2.

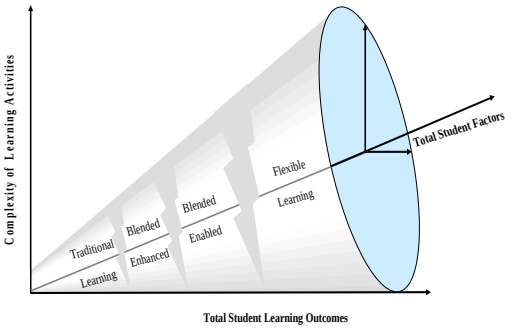

Figure 2: The Cone of Learning Reconstruction, adapted from Hamilton and Tee [26].

Research Study

We now test the model above using the four teaching and learning modes outlined above against 224 first year business students, with constructs developed from a literature and focus group based, seven point Likert scale teaching and learning modes questionnaire, built under normal survey instrument validation and development approaches [21]. We engage a structural equation modelling approach, investigating possible paths and path strengths, and observing the levels of total learning effects generated under each model. We follow the structural equation modeling procedures of Hamilton and Tee, [26], and apply this research against the well established Biggs [6] 3P teaching and learning approach. We rearrange this approach using the teaching mode as the independent construct, and use this teaching-generated learning experience setter approach to generate the Biggs four construct blocks for each of the traditional, blended-enhanced, blended-enabled and flexible teaching and learning mode delivery systems. We model our study as shown in Figure 3.

Experience Setter

To fully investigate possible pathways we also test for an additional pathway to that used by Biggs [6], and test for a path between student factors and learning outcomes.Factor reduction of potential construct measures (all measure residuals below 0.05 and with no cross-loading measures above 0.3) delivered reliable, internally consistent, single indicator constructs for each teaching and

learning mode learning block. Using each resultant factor reduction construct, along with corresponding Cronbach alpha (each was above 0.75 indicating composite reliability), and its associated standard deviation, the relevant construct load and associated error are determined [37]. The structural equation models, built in AMOS 16, are then developed, exposing all the relevant significant paths for each teaching and learning mode. No significant bi-directional pathways were found. Bootstrapping successfully checked sample invariance and the Bollen-Stine p was above 0.05 - as required for each model. Model fit measures for each teaching and learning mode are displayed in Table 1.

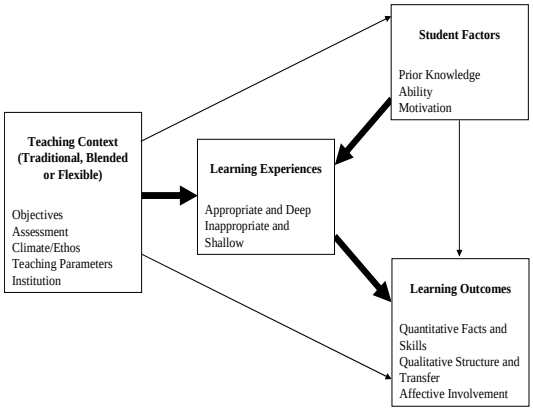

Figure 3: Biggs 3P Model used as Learning

Discussion

Our four teaching and learning mode models, with their key measures shown in Table 1, in each case, display excellent 'goodness-of-fit' across all parameters. Our net-learning pathways effects into each learning block (shown in Table 2) also demonstrate that blended learning delivery mode systems may be further split into two distinct blocks, with blended enabled learning delivering higher degrees of net-learning-effects. This study also indicates that as the student factors like personal skills and ability, and motivation increase the student's capacity to operate in a more flexible environment, and to draw in higher levels of learning increase. This in-turn also impacts on increased levels of student perceived learning achievements or outcomes.

This study also lends support to the 'Cone of Learning', with more complexity in learning offerings and challenges, also driving greater student perceived learning outcomes. Traditional teaching and learning (as the simpler learning structure) is seen by students as a low net-learning environment. The blended-enhanced teaching and learning mode, with components of negotiated work in combination with traditional mode activities, is seen as the next strongest learning deliverer. The blended-enabled teaching and learning mode also capturing traditional and blended-enhancing offerings is perceived by students as offering the next highest overall net-learning-effects solution. The flexible teaching and learning modes delivery system where: anytime, anywhere, anyhow, individually-negotiated learning, is recognised by tertiary institutions and by participating students as legitimate, is seen as the learning system capturing aspects of the other modes where appropriate, whilst also delivering highest net-learning outcomes.

Table 1: Learning Experience Setter Teaching Model Goodness of Fit Measures

Traditional Learning Mode Parameter Estimates Generated					
Chi Sq	15.495	df	11	Bollen-Stine p	0.828
RMSEA	0.043	RMR	0.05	TLI	0.984
CFI	0.992	GFI	0.981	AGFI	0.951
Blended Enhanced Learning Mode Parameter Estimates Generated					
Chi Sq	15.965	df	10	Bollen-Stine p	0.703
RMSEA	0.051	RMR	0.036	TLI	0.978
CFI	0.99	GFI	0.98	AGFI	0.943
Blended Enablend Learning Mode Parameter Estimates Generated					
Chi Sq	18.394	df	10	Bollen-Stine p	0.572
RMSEA	0.061	RMR	0.034	TLI	0.972
CFI	0.987	GFI	0.978	AGFI	0.938
Flexible Learning Mode Parameter Estimates Generated					
Chi Sq	10.823	df	9	Bollen-Stine p	0.975
RMSEA	0.03	RMR	0.037	TLI	0.993
CFI	0.997	GFI	0.987	AGFI	0.958

Table 2: Net-Learning-Effect Measures Delivered from Different Teaching Mode Approaches

CONSTRUCTS	Traditional Learning Mode	Blended Enhanced Learning Mode	Blended Enabled Learning Mode	Flexible Learning Mode
Student Factors	0.34	0.41	0.62	0.74
Learning Experiences	0.43	0.42	0.52	0.60
Learning Outcomes	0.30	0.40	0.48	0.51
Average	**0.35**	**0.41**	**0.54**	**0.62**

Finally, this study also supports the existence of an increasingly complex learning continuum as proposed by Bonk and Graham [7], and Georgouli, Skalkidis, and Guerreiro [20]. Here, higher levels of student factor, learning experience and learning outcomes all suggest movement in the same positive net-learning-effects direction - as teaching and learning modes move from traditional towards flexible learning approaches, As such, this work suggests the static four quadrant view of teaching and learning previously presented by Collis and

Monen [11], should be shown as a learning continuum, with no clear boundaries between learning modes as shown in our Cone of Learning.

Conclusions

Tertiary teaching and learning modes, built on teaching context constructs outlined herein, show differences in net student learning effects and these can be 'fitted' into a 'Cone of Learning' continuum. Here, four zones of increasing complexity in teaching and learning mode (traditional, to blended-enhanced, to blended-enabled, through to flexible) offerings may be engaged, with each mode housing a different set of net student learning options. This results in different levels of perceived student learning outcomes being achieved.

The 'Cone of Learning' continuum, arising as one moves from the base level (or traditional teaching and learning mode) through to more complex teaching and learning mode approaches, indicates students perceive that differing degrees of teaching modes and approaches, deliver different net-learning outcomes, and that these may be explained as a single teaching and learning mode, or under more complex learning approaches as some combination of selected teaching and learning mode components as suggested by this research. If developed and used wisely the 'Cone of Learning' may be used to build a powerful tertiary institution teaching and learning positional and benchmarking tool.

This research is not able to capture the exact transition borders between the teaching and learning mode levels within the 'Cone of Learning' and it is seen as a continuum with blurred boundaries, and showing various degrees of overlap across modes and across transitions. Further, we cannot prove there are only three dimensions to the 'Cone of Learning' continuum, nor can we definitely conclude the three dimensions of Biggs 3P model used herein definitely act at ninety degrees to each other. Finally, it is likely that a fourth dimension – time exists and that the model is even more complex than that shown. We suggest this because we suspect, multi-level, hierarchical model development options may exist, and further these may also require the capture additional dichotomous (or even ordered categorical) outcomes constructs. Hence, new longitudinal surveys, along with structural equation modeling and Mplus analysis toolkits may be required to research such situations.

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