Effectiveness of Technology Enhancement in Blended Learning: An Instrumental Perspective

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Abstract. Studies on institutional policies on the use of technology in blended learning reveal that technology choices and policy implementation are largely governed by three common perceptions: (1) technology *per se* has its own logic of effectiveness and operation, (2) the choice of technology is based on its utilities across contexts, and (3) the application of technology is pre-determined. However, this commonality overlooks the existence of various factors that shape the effectiveness of technology at different stages of application.

This paper examines, via the perspective of policy instrument, various factors that may hinder or facilitate the effectiveness of technology in blended learning. The use of technology is conceptualized as a policy instrument in the process of formulating and implementing institutional policies on blended learning. Its effectiveness is analyzed using four theories of policy instrument, namely the 'classical', 'contextual', 'instrument-context' and 'constitutive' approaches to instrument. Results of the analysis show the dynamic nature of effectiveness which should be considered when formulating institutional policies on technology-enhanced learning.

Keywords: Institutional policies, technology as policy instrument, effectiveness of policy instruments, blended learning.

1   Introduction

In virtually all aspects of education, application of technology has become commonplace in educational institutions. Mars and Ginter summarize a variety of reasons for the increasing use of technology in education [1]. First, technology-based models of learning are adopted by educational institutions to make operations more efficient and cost-effective. Second, these models are used as alternative methods of course-delivery to expand student markets and reach those students who would otherwise not be able to attend conventional face-to-face on-campus classes due to geographical or other difficulties. Third, their use enables programmes and courses to be regularly updated to enhance student enrolment capacities and in many cases to bring course content more in line with the increasingly high-tech economy.

The notion that 'technology can do' stems in part from the vast number of studies that have reported relatively positive effects of the use of technology on learning outcomes,

e.g. [2][3][4][5]. In particular, Ali and Elfessi investigated the performance of two groups of student by offering virtual and conventional settings respectively, where no significant difference was observed in performance between the two groups, implying that the virtual setting could serve as an alternative to the conventional one [6].

However, an increasing number of studies have also reported that technology does not necessarily bring about positive effects on teaching and learning [7][8][9]. Sometimes there are even negative experiences and outcomes [10][11][12][13]. Therefore, there is a need to understand the factors that influence the effectiveness of technology-enhanced learning in order to properly utilize technology in education.

This paper examines various factors that may hinder or facilitate the effectiveness of technology in the context of blended learning as a 'critical case'. Arguably, compared to full e-learning models such as 'massive open online courses', the proportion of technology used in blended learning is smaller as it normally consists of both traditional face-to-face classroom setting and some form of e-learning. The strategic importance of a 'critical case' is that "if this is valid for this case, then it applies to all cases" [14]. Thus, if the factors examined in this study impact on the effectiveness of blended learning, (to deduct logically) it is then likely that the same factors would also influence the effectiveness of other learning models that embrace full e-learning settings. An analysis of the case of blended learning is, therefore, strategically imperative for understanding the effectiveness of learning models based entirely on e-learning environments.

To understand different factors that influence the effectiveness of blended learning, this study as a preliminary endeavour borrows the concept of 'policy instrument' from the field of social sciences and conceptualizes this mode of learning as a means to accomplish the policy objectives of an educational institution. This conceptualization allows an analysis of the effectiveness of technology use in blended learning as a policy instrument by using theories in the social sciences field which, as will be shown, produce distinctive factors that shape its effectiveness.

2   Blended Learning as an Institutional Policy Instrument of Technology-Enhanced Learning

The concept of 'policy instrument' is commonly used in studies of government and public policy [15][16], referring to a method or means used by governments to achieve a desired effect. For example, 'assessment' has been used by educational authorities to accomplish educational success in terms of reportable rising levels of attainment[17].

However, the use of 'policy' and 'policy instrument' is not limited to governmental institutions. Educational institutions have their own visions and/or missions, and will formulate various institutional policies to achieve them. In Utah Valley University (UVU), for instance, 'policy' is defined as "a set of principles intended to govern actions" which "can represent the strategic direction or operating philosophy of an organization", and an 'institutional policy' is defined using the following criteria:

- It is a governing principle that mandates or constrains actions.
- It has institution-wide application.
- It will change infrequently and sets a course for the foreseeable future.
- It helps ensure compliance, enhances the University's mission or reduces institutional risk.
- It is approved at senior levels of the institution [18].

Technology is in many ways a policy instrument used by institutions to achieve a variety of institutional policy goals. For example, information technology was introduced as a policy instrument by the UK Department of Health and Social Security in 1959 for modernizing the nation's social security system. The goal was to improve operational efficiency and flexibility, reduce administrative costs, replace repetitive and routine tasks, allow a greater degree of information disclosure, and enhance the quality of public services [19]. Cohen has observed that information technology such as the Internet might decrease the cost of information dissemination and enable information to reach a large population of targeted beneficiaries [20].

Technology-enhanced learning tools or materials, such as open educational resources (OER), have been seen as policy instruments which help to achieve various educational purposes at an institutional level. Ferran et al regard OER as a policy instrument of higher education institutions to facilitate flexible learning experiences, enhance transparency in learning paths, and enable greater accessibility to the learning materials in order to reinforce the concept of lifelong learning [21].

Blended learning as a technology-enhanced learning model can, therefore, be viewed as a policy instrument to achieve institutional policy goals. Colis and Moonen refer blended learning to the instruction taking place both in the classroom and online environment [22]. Harding, Jaczynski and Wood have observed that blended learning is "a mixture of online and face-to-face learning using a variety of learning resources and communications options available to students and lecturers" [23] (p. 56). This mode of learning as an institutional policy instrument thus offers institutions an alternative to pursue their intended policy objectives.

3 Effectiveness of Blended Learning: Four Instrumental Factors

By conceptualizing blended learning as a policy instrument, its effectiveness could be analyzed through various theories of policy instrument in policy studies. Peters and Van Nispen classify these theories into four types: 'classical', 'contextual', 'instrument-context' and 'constitutive' [15]. Table 1 summarizes their foci of analysis.

Table 1. Overview of focus of analysis by type of instrumental factor

Instrumental factor	Focus of analysis
Classical	Nature and character of educational technology
Contextual	Implementation process
Instrument-context	Requirements of a teaching and learning problem setting
Constitutive	'Subjective meaning' of educational technology

The 'classical' theory of instruments [24][25] values the importance of the nature and character of policy instruments in determining the course of the policy process. In the context of technology enhancing learning, this theory explores the nature of the learning mode—how its characteristics or features determine the teaching and learning setting, its impact and expected effects on teaching and learning experiences and outcomes. The underlying assumption of this theory is that instruments possess distinctive characteristics and nature attached to their logics of operations and functions. Each instrument by its very nature determines the design of the implementation activities with distinctive effects on teaching and learning as well as outcomes. The nature and character of instruments can be applied across contexts. Institutional policy makers can be informed about the application and choice of instruments based on their utility across contexts which in reality are predetermined in most cases.

The analysis of the 'contextual' theory focuses on factors relevant to the situation in which the policy is applied, especially those within the complex process of making instruments operate [25][26]. Substantial emphasis is placed on examining the role of the implementation process, identifying various contextual factors such as the quality of technology infrastructure and level of support for technology users. This theory argues that while instrumental differences may exist, it is questionable whether instruments of any kind can be applied universally as contextual factors are powerful in swaying the way they operate and their intended level of effectiveness.

The focus of analysis of the 'instrument-context' theory locates somewhere between the above two. This school of thought places a lot more attention on bridging over contextual problem settings and instruments as solutions, i.e., to understand relevant teaching and learning problems and identify suitable solutions to them. Technologies may provide options from which institutional policy makers may choose, but it is not, as this theory may argue, the only option. In line with this theory, the first and foremost task is to identify relevant requirements of a teaching and learning setting, and to make instrumental choices based on the extent to which the instrument is able to fulfill the requirements.

For the 'constitutive' theory, it is argued that understanding instrumental effectiveness should go beyond all objective evidence and consider subjective meanings of instruments. "What do people think" is the central question of this theory. It is sociocultural and normative, and is therefore subject to social construction and reconstruction. The focus of this theory is in many ways about the extent to which people accept the use of technology in education.

4   Institutional Policies on Blended Learning

The four types of instrumental theory, in essence, shape or determine the effectiveness of blended learning as a policy instrument of technology-enhanced learning. This section reviews relevant studies on institutional policies on blended learning in order to examine how the various instrumental forces sway differently the effectiveness of this mode of learning.

4.1   Character of Blended Learning

In line with the classical theory of instruments, the character of blended learning renders a critical factor that determines its effectiveness. An integration of traditional face-to-face classroom setting and some form of e-learning has been considered as the primary characteristics of blended learning [27][28]. Mitchell and Honore define blended instruction as "learning involving multiple methods and approaches, commonly a mixture of classroom and e-learning" [29] (p. 149). Delialioglu and Yildirim suggest that blended instruction refers to the mix of classroom instruction and online instruction with which benefits of both instructional modes could be achieved [30].

Relevant studies have attempted to explore explicit and observable benefits of blended learning. For example, Garrison and Kanuka claim that blended learning provides large numbers of learners with interactive learning experience in an accessible and cost-effective way through the Internet [31]. Dowling, Godfred and Gyles consider blended learning a teaching model allowing flexibility by delivering learning contents electronically while keeping regular face-to-face classes [32]. To maintain their economic competitiveness, many countries have developed policies to increase the participation of adults in higher education. Broek and Hake have observed that distance and blended learning has been one of the policy instruments that governments employ to increase the participation of adults in higher education by reducing the costs of learning and making higher education more accessible [33].

Studies have also examined the cost-effectiveness and direct impact of blended learning on learning outcomes. Dean et al. show that blended learning programmes "can be completed in approximately one-half of the time, at less than half the cost, using a rich mix of live e-learning, self-paced instruction, and physical classroom delivery", and that this programme design was also able to contribute to "an overall 10% better learning outcome than the traditional classroom learning format" [34] (p. 247).

The character of blended learning, therefore, justifies its utility as an alternative learning mode in the teaching and learning process and its existence as a key component of educational administrators' 'toolkit'.

4.2   Implementation Process

The implementation of blended learning involves a set of contextual factors determining the effectiveness of this policy instrument. A contextual factor of this kind is availability of resources. Wallace and Young's case study shows that blended courses at the early stage were delivered with existing resources or given 'special project' status, and they in general lacked an implementation plan to cover institutional resources, reward structures, and priorities [35].

The ability of students to learn independently has been identified as a crucial factor that shapes the effects of blended learning on learning outcomes. Snodin assessed the effectiveness of blended learning by involving learners to autonomously organized resources in a course management system, and found that such effectiveness depends on how well learners' autonomy is inspired [36]. Kemmer finds that learners need to take responsibility for their learning in order to fully benefit from blended learning [37].

A suggestion is thus made to enhance students' understanding of the demands of online learning and its contribution to their learning. Napier, Dekhane and Smith collected qualitative feedback from students after trying a computing course in the blended mode [38]. Participating students responded that being responsible for their own learning and managing time properly are key factors to the success of blended learning.

Learners' understanding of the use of technology and ability to master the online technology component of blended learning play an important role in determining the success of blended learning in the implementation process. Kemmer observed that learners' understanding of the use of technology to facilitate their independent learning is one major factor towards the success of blended learning [37]. Carter and Salyers highlight the significance of technological readiness in the blended mode [39]. As they reviewed, learners who are self-confident in mastery of technology tend to "perform better in and be more satisfied with blended and online learning environment than those with lesser skill with technology" (p. 444). Ratz observes the correlation between readiness in technology and learners' interest in blended learning [40]. According to her findings, higher confidence level is shown in younger and male participants, who are also more interested in adoption of blended learning. Kim, Bonk and Oh find that, among the various obstacles to adopting blended learning, fast-changing technology is rated as the most significant one [41]. They suggest that both learners and practitioners have to keep themselves updated about the latest technologies for teaching and learning.

Another critical concern lies in the extent to which pedagogical design of a course fits a learning setting that consists of both traditional classroom and online setting, as well as teachers' ability to master both platforms. Precel, Eshet-Alkalai and Alberton highlighted that the importance of completing the pedagogical design of online learning component of blended learning in advance was acknowledged by students [42]. Werth, Werth and Kellerer's study on the impact of blended learning on students and teachers has shown that the ability of teacher to be innovative was positively correlated with (1) his or her ability to provide one-to-one instruction; (2) self-efficacy/confidence; (3) ability to monitor student learning; and (4) enjoyment of teaching [43]. Their study also pinpointed the importance of identifying and incorporating pedagogical strategies particularly pertinent to blended and online teaching into teacher preparation for new modes of education.

Planning and monitoring of staff workload has also been a key to effective blended learning. Mclntyre, Watson and Larsen pointed out that the balance of workload together with time management was, among others, a problematic issue relevant to any large-scale implementation of blended learning [44]. Tynan et al. observed that workload planning for staff is an essential part of the process of designing blended learning, and that most universities did not have at the early stage centralized procedures or guidelines for allocating academic workload on blended learning [45]. Russell argues that the move from traditional campus university teaching to blended learning can be hampered by lack of planning and monitoring of staff workload [46].

The interplay of barriers and enablers in the implementation process, therefore, bring about a great challenge to the effectiveness of blended learning in practice.

4.3   Requirements of a Teaching and Learning Problem Setting

According to the instrument-context theory, central questions may involve whether relevant requirements of a teaching and learning problem setting allow technology-enhanced learning to play a role in that setting, and if so, whether it necessarily means blended learning. Blended learning, as mentioned earlier, is primarily characterized by a combination of some degree of traditional face-to-face classroom-based and some form of off-campus online-based settings. Programmes or courses that are considered better delivered by either one of the two settings may not provide the necessary institutional incentive for a policy on blended learning.

Rolfe et al. documented that science staff conceived their academic subjects as suitable for the use of e-learning and were more aware of the potential benefits of e-learning, whereas staff in the arts subjects tended to hold that their academic subjects were based on more in-depth analysis and discussion that could hardly be supported by e-learning activities [47]. Given such difference in staff's perception, Rolfe et al conclude that application of e-learning in arts subjects does not bring as much benefit as that in science subjects in terms of learning the subject matter [47].

The increasing transformation of course-delivery from conventional in-class to e-learning setting through the use of technology-enhanced learning device may mean that using blended learning for a full delivery of relevant courses would be hindered by this instrument's nature to request for some elements of conventional in-class environment. To take an example, international partnerships such as 'OpenupEd' [48] were established to deliver educational services for lifelong learning by providing programmes or courses that are fully delivered online (and can be completed for free for an informal credit). Lifelong learners may well opt for this kind of online and conditionally free learning mode rather than blended learning for which they often have to settle a payment at least for the usage of classroom equipment and facilities.

Thus, while blended learning may be found in education administrators' 'toolkit', it may be just a tool 'ready for use only' and may not be used at all. Its application, in accordance with the instrument-context argument, depends on what a teaching and learning problem setting would call for in the first place.

4.4   Acceptability of Blended Learning

The extent to which blended learning is accepted by educational stakeholders (especially learners) has been a critical factor for the effectiveness of blended learning in terms of participation and course dropout. Learners' and teachers' perceptions, attitudes and preferences have therefore been crucial variables in examining the acceptability of blended learning, which provides the necessary legitimacy for an institutional policy on blended learning.

For instance, in a comparative study that Chen and Jones reported on business students' assessments of course effectiveness and their overall satisfaction with an accounting class, one group of students were offered a traditional face-to-face classroom setting and another group a blended-learning setting in which online method was supplemented by a few occasions of in-class meeting [49]. They summarized the following relatively encouraging results:

"Overall perceptions of the course, instructor and learning outcomes were positive for both groups. …However, some interesting differences were noted. Specifically, students in the traditional setting were more satisfied with the clarity of instruction. On the other hand, students in the blended-learning section felt more strongly that they gained an appreciation of the concepts in the field. Blended-learning students also indicated more strongly that their analytical skills improved as a result of the course. The results suggest that the two delivery methods were similar in terms of final learning outcomes, but that both may be improved by incorporating aspects of the other." (p. 1)

However, as the constitutive theory of instruments would argue, the subjective meaning of blended learning can be constructed and reconstructed from time to time and across contexts, resulting in various levels of effectiveness of this instrument accordingly. Learning style preferences have been an important variable of acceptability of blended learning. Akkoyunlu and Soylu find that students' perceptions on blended learning are affected by their learning styles [50]. Following Kolb's Learning Style Inventory [51], Akkoyunlu and Soylu categorized students into four learning styles, namely divergers, assimilators, covergers and accommodators [50]. Their findings reveal that, for example, divergers who prefer concrete experience in learning tend to be in favor of more interactions with peers and teachers. In contrast, assimilators who prefer abstract conceptualization in learning prefer a lecture setting. Tempelaar, Rienties and Giesbers also observed the difference of students' learning styles in relation to learning effectiveness [52]. According to their findings, less academically-inclined students, such as those taking a "surface" approach to learning, benefit most from learning statistics in a blended environment. Banerjee surveyed students' perception on blended learning [53]. It is found that students who are visual learners prefer seeing things done as an example rather than figuring them out on their own. Banerjee also finds that only certain disciplines are preferred in blended mode [53]. Computer science, for example, is a discipline involving complicated concepts and students prefer learning it with face-to-face interactions with a teacher.

Teachers' orientations and preferences are equally, if not more, imperative considerations in making technological choices and putting it into practice. Benson, Anderson and Ooms documented that academic staff's perceptions, attitudes and practices in blended learning can be varied [54]. In the case of business and management education, they developed a typology of three distinct approaches to blended learning from the staff's perspective, namely "technology is all", "Bolt-ons" and "purely pedagogic", each of which represents a different degree of participation in blended learning.

Cultural variances as a result of geographical differences may render an explanation for various views of teachers about the integration of online collaborative learning in blended learning [55], but the existence of pluralistic perspectives on the concept of blended learning is also not surprising even in monistic cultural context. This highlights the importance of introducing proper mechanisms to sustain the solidarity of a teaching team for effective blended learning. Salmon, Jones and Armellini's study has demonstrated that effective capacity building for staff teams is critical in enhancing outcomes of blended learning or other e-learning modes [56].

Thus, even though blended learning as a tool is preferred by education administrators, its applicability is still affected by other educational stakeholders' acceptability.

5   Conclusion

This paper has attempted to argue that some common assumptions underlying institutional policies on technology-enhanced learning (i.e., technology *per se* has its own logic of effectiveness and operation; the choice of technology is based on its utilities across contexts; and the application of technology is predetermined) overlook the existence of various factors that shape the effectiveness of technology at different stages of its application from technological choice to implementation.

Through the instrumental perspective, this study has examined various instrumental factors that may hinder or facilitate the effectiveness of the use of technology in blended learning as an institutional policy instrument of technology-enhanced learning. A review of relevant studies has revealed that such effectiveness is influenced not only by the character of blended learning, but also the implementation process, requirements of a teaching and learning problem setting and teachers' and learners' acceptability of this particular form of technology-enhanced learning.

The integration of technology-enhanced learning in education has been an ongoing trend and formulation of relevant policies remains a top item in the agenda of institutional policy making. Deliberation of educational administrators in making technological choices should focus on, in addition to the character of educational technologies, whether there is a need for such a technology in education, and if so, which form and type of the technology, what possible barriers and enablers are likely to happen in the implementation process and the extent to which applications of technology in educational services are accepted by learners and staff members as well as other relevant stakeholders.

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