

Student Characteristics and Learning Outcomes in a Blended Learning Environment Intervention in a Ugandan University

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Abstract: This paper explores the design of a blended learning environment in a transition from face-to-face and seeks to determine whether learner characteristics and background together with blended learning design elements are significant factors for learning outcomes such as intrinsic motivation, satisfaction, knowledge construction and learning performance in blended learning. It is aimed at examining the learner characteristics and backgrounds such as age, gender, self-regulation, attitudes, family and social support as well as the management of workload in blended learning. It is again to find out the levels of use and satisfaction with blended learning design features such as interactions, learning management system tools and resources, face-to-face support and technology quality by learners. Students from three schools and one directorate were involved in a face-to-face set up in the first part of a seventeen week semester and in an online set up in the second part. They finally had a face-to-face at the end to review their work after which they took end of semester examinations. A questionnaire survey was administered to 270 respondents in this group to gather data on student characteristics and background, design features and three of the outcomes. The examination results were used as a measure of the performance variable in the learning outcomes. We applied the online self-regulated learning questionnaire for data on students' self-regulation, the intrinsic motivation inventory for data on motivation and other self-developed instruments to measure the other constructs. Descriptive statistics showed that the identified learner characteristics manifest strength for blended learning design and the learners' involvement with design features was found to be high and satisfactory. ANOVA results showed no significant differences between age groups in performance and t-test results showed no significant differences between male and female students. Regression analysis results showed learner attitudes as predictors of learner satisfaction and motivation while workload management is a significant predictor for learner satisfaction and knowledge construction. Among the design elements, regression results showed only learner interactions as significant predictors of knowledge construction and satisfaction. As a consequence, a number of learner characteristics and design features are seen to be important for blended learning design and the non-significant ones remain a focus for future research.

Keywords: Student characteristics, blended learning design, learning outcomes and learning management system

1 Introduction

The design of a blended learning environment in this study is an aspect of instructional design and has a lot to do with innovative pedagogy for improved teaching and learning using technology in Uganda. It is noted especially by Schellens (2004) that the design of a learning environment is very important for stimulating and supporting student learning. The design in this study involves a transition from traditional face-to-face teaching-learning to blended learning with technology. The focus of this study is mainly on how to design a motivating and supportive blended learning environment as an attempt to transit from traditional face-to-face, paper based course delivery methods to more advanced methods involving technology. We incorporate an instructional design component in this study in order to study this transitional undertaking. The transition is geared towards exploring various alternatives that can foster exploration in learning by applying the use of modern information communication technologies. This means a re-invention of teaching and learning in university relevant for the 21st Century (Laurillard 2002). We note that individual differences play a big part in student learning and so this study considers student characteristics and background in terms of their demographics and social aspects. It also highlights what learning in blended environment can lead to in terms of outcomes when technology is applied in education through an intervention.

2 Literature review

This literature review explores individual student characteristics that play a part in student learning particularly in a blended learning environment. It further shows how students make use of a designed blended learning environment to their satisfaction and to achieve learning outcomes. The variables under review have been

singled out due to the study setting. The learner characteristics, out of the researcher's experience at Mountains of the Moon University in Uganda, have been issues of concern in student learning. Levels of support by supervisors and peers at work and the degree to which their jobs allow an opportunity for learning can affect blended learning success. Emotional family support has been found to predict effects of online learning as noted by Chu and Ju (2010). Managing study activities in any learning environment is important and needs self-regulatory skills by both young and old. Issues of technology quality, on-line and face-to-face interactions as well as use of a learning management system with its tools and resources are design features that form the medium for student learning. These have been grounded in the literature to show how they are used by learners to achieve satisfaction, learning performance, motivation and knowledge construction as learning outcomes in the design of blended learning.

2.1 Students' characteristics and background in a blended learning intervention

2.1.1 Self-regulation

Self regulation is a significant and critical aspect in learning (Barnard et al 2009). Students need to control the various resources available to them in learning such as learning time, the study environment as well as help available from peers and instructors (Pintrich 2000). The adoption of self regulated learning strategies (Boekaerts and Corno 2005) leads learners in learning environments to efficiently manage learning activities. The key to such learning outcomes as knowledge construction and intrinsic motivation lies so much in the ability of learners to regulate their own learning processes (Cleary and Zimmerman 2004).

2.1.2 Attitudes towards blended learning

There can be effective application of learning strategies where positive attitudes towards learning exist (Haddock and Maio 2009). Zhu, Au and Yates (2013) identified attitudes towards ICT usage, subject area, intrinsic and extrinsic motivation and on-line learning as factors that influence students' attitudes towards on-line courses. Studies show that there has been satisfaction with blended learning thereby showing a positive attitude to such a learning environment (Yilmaz and Orhan 2010).

2.1.3 Family and social support

Parental support for learner success in blended learning is vital (Black 2009; Russel 2004) and emotional family support predicts effects of e-learning (Chu 2010). The existence of family support especially in regard to IT applications is known to decrease anxiety related to IT usage (Bimber 2000), and in our situation, involving technology in learning is a challenge for many learners, which calls for tangible family support (Chu 2010).

Social support as a theory discusses sources of positive or protective influences associated with individuals' social relationship and network (Berkman et al 2000). Online collaborative learners need to have feelings of connectedness and belonging promoted because they are considered as critical factors in online learning (Hara, Bonk and Angeli 2000). Jacobson (1986) named informational, instructional and emotional supports as other types of social support necessary for success in learning environments. In the context of this study, some learners at the age of 24 are still supported by parents in university. We therefore examine the need for support emotionally, financially or otherwise for blended learning success in this intervention.

2.1.4 Management of Workload

YukselTurk (2010) found out that various responsibilities and occupations accounted for the low levels of interaction with peers. Holley and Oliver (2010) noted that assessment pressures at work and expectations for them to acquire independent study skills in a short time will always give a low chance of accessing academic time. Learner management of workload needs examination as a vital aspect for blended learning interventions.

2.1.5 Computer competences

Students' knowledge and skill in computer applications can be a drive in the use of technology in learning while deficiency makes it difficult for them to learn (Lofstram and Nevgi 2007). Students' comfort with IT tools makes them interface better with given tools used in blended learning (Kvavik and Caruso 2005).

2.1.6 Gender and age

Research shows that female learners do not comparatively do well in science and technology (Crombie and Abarbanel 2000) and in male dominated environments (Phan 2001). Boys' heavy use of computers and their positive attitudes resulted into outperforming girls in ICT literacy (Volman and Eck 2001). In some cases there are no significant differences in the academic achievement grades of male and female students though in the pre- and final test of traditional and blended learning environments respectively showed female students' performance was higher (Yasar and Demirkol 2014). Hoskins and Hooff (2005) noted age as a predictor of achievement and older students do better than younger ones in online learning. There were however no differences in performance between the old and young learners in online environments (Colorado and Eberle 2010).

2.2 Blended learning design features

2.2.1 Interactions in blended learning

Student-student interaction for learners helps them to meet online in order to get a feeling of community belonging (Sorden 2011). Garrison (2009) indicated that social presence occurs as learners identify and communicate with a community and develop relationships. Meaningful and academically rich interactions between students are helpful for learning as well as being enablers of learning (Tu and Corry 2003).

Student-faculty interaction ensures successful learner outcomes in blended learning (Smulsky2012) and frequent contact brings student motivation as well as involvement (Chickering and Gamson 1987). The value of student-faculty interaction is emphasized by Chen, Gonyea and Kuh (2008) in encouraging learner engagement, satisfaction and successful results of the learning process. The main responsibilities of staff in ensuring meaningful interactions with learners lie in clearly showing how learners will access the instructor and timely response to learners' concerns, (Graham et al 2001).

The learning process is again significant when it involves learners being active, interactive as well as reflective in their learning (Payne 2007). The use of the discussion forum to exchange knowledge through participation in discussions can benefit learners by allowing them to dialogue with peers and self-reflection which leads to knowledge construction, (Chen and Looi 2007).

2.2.2 The use of the LMS and its tools

The perceived functionality of any learning management system in on-line learning affects learner attitude to the usage (Pituch & Lee 2006). Through Moodle, Amandu, Muliira & Fronda (2013) noted that learners are able to get course materials like notes, power point slides, videos, journal articles and hand-outs which aid learners in self-directed learning. Learners fondly make use of features such as accessing lecture notes and materials, uploading coursework as well as accessing grades while the use of the calendar, forums and personal messages were least used (Norris, Sporre & Svendsen 2013). The survey by Berg and Lu (2014) indicated that the student satisfaction with Moodle was mainly in the ease in searching for course information on the system as well as downloading and uploading assignments with ease and convenience on the system.

Tools like the discussion forum are known to promote interaction and discussion as well as increase student engagement fostering critical analysis, reflection and the social construction of knowledge between learners in addition to giving assistance in building learning communities, (Garrison 1993). The use of the forum enhances active learning and developing learner thinking capacity and motivates learners to learn more, (McKeachie et al 1986). The chat and news forum are good in sharing information and announcements as well as seeking clarity on what is not understood ((Amandu, Muliira & Fronda 2013).

2.2.3 Technology quality

Technology quality including internet quality has a significant effect on satisfaction in online learning (Piccoli, et al 2001). Once there is high quality and reliability in IT, there is assured high learning effects (Piccoli, et al 2001). Othman and Musa (2012) indicated that the internet browsing speed is most critical as well as campus internet access reliability.

2.2.4 Face-to-face support

Satisfaction with face-to-face was indicated by Reisetter (2007) and Akkoyunlu and Soylu (2008) showed that face-to-face sessions ensure interactions. The proportions of online versus face-to-face sessions vary considerably according to studies. Ranganathan et al (2007) found out that the proportion varies from 75% online with 25% face-to-face to 13% online with 87% face-to-face and that this was largely dependent on the given institution. He finally proposed that consideration should be given to students, professors and institutions to determine the online and face-to-face proportions.

2.3 Learning outcomes in blended learning

2.3.1 Intrinsic motivation

Intrinsic motivation is considered as a learning outcome because it is used to measure the learners' experiences with regard to the experimental tasks set in the blended learning intervention. Emotional feelings of anxiety, nervousness and tension among learners taking part in blended learning environments can negatively influence their intrinsic motivation. The state of learner anxiety for instance, can result from, among other factors, the utilization of a learning management system or the tasks to be attempted therein (Saadè and Otrakji 2007). Again, much as course grades are usually used as indicators of student achievement, affective factors are also as good as cognitive factors in indicating outcomes of learning (Kuo et al 2013). Doing work with ease, fun, enjoyment and competence have been found to indicate learners' intrinsic motivation (Kremenska 2009) and call for examination in this study to establish the success of a blended learning intervention.

2.3.2 Satisfaction

Naaj, Nachouki and Ankit (2012) noted that the satisfaction of learners under blended learning environments is the baseline requirement in order for a successful implementation plan. Debourgh (1999) found a high correlation between learner satisfaction and the course instructors' performance especially in regard to availability and response time to students.

Reliable and accessible equipment in terms of technology is vital for learner satisfaction, (Bower & Kamata 2008). The frustration of learners with technology involved in blended learning often leads to low satisfaction in the learning process as noted by Chong (1998). Research further shows that the planning of the course content and its teaching in blended learning environments are known to lead to learner satisfaction (Debourgh 2003). Jones and Chen (2008) found out that the course instructor kept learners up-to-date and gave prompt feedback and that learners made extra effort to interact with the instructor as compared to a traditional classroom. In many studies learners have indicated satisfaction though some aspects do not measure to perfection in some other studies (Giannousi et al 2009; Jones and Chen 2008).

2.3.3 Knowledge construction

Research indicates that the process of learning from others as a way of knowledge construction in online learning produced results through learners exchanging ideas as well as sharing information (Rahman, et al 2011). High levels of knowledge construction were found in a doctoral program in which the instructor had well designed learning programs and assigned roles geared towards learner acquisition of their own knowledge, (Lai 2013). Helling and Petter (2010) reported a situation whereby learners were able to post opinions to questions that were initiated by instructors in task descriptions.

2.3.4 Learning performance

Comparisons of learner performance while doing traditional face-to-face instruction and blended learning have previously shown that blended learning instruction yields better performance (Hill, Chidambaram and Summers, 2013) although the contrary has also been found out in other studies (Brown and Liedholm 2002). Kwak, Menezes and Sherwood (2013) found no effect of blended learning on the performance of students in a statistics course. In the final analysis we note that some particular studies report performance in blended courses to be the same as in traditional face-to-face (Delialioglu and Yildirim, 2009), superior or better (Atan, Rahman and Idrus 2004) or even worse (Brown and Liedholm 2002).

Given the reviewed literature, successful designs of blended learning environments require a successful examination of learners’ characteristics and backgrounds and the technologies involved (El-Deghaidy & Nouby 2008). There is no particular existing theory that sufficiently explains the phenomena under consideration in this study. The research therefore borrows from Bean and Metzner’s (1985) framework of online drop-out considering factors prior to the course and those during the course. Prior to the course factors include learner characteristics of gender, age, employment status among others and during the course factors such as time conflict, family issues as well as technological aspects. In addition, Tinto 1987, 1993) also shows that student interactions are known to lead to learner persistence in online courses and many students get affected by the balance between class, work, family and community roles (Graham & Gisi 2000). Bean and Metzner (1985) further refer to learners above 24 being greatly influenced by their reference groups including peers, friends, family and employers. They also identify age, hours of employment, family responsibilities and outside encouragement as factors affecting learner persistence in online courses. Based on the above presented literature, we developed the conceptual model of the present study.

3 Research objectives and questions

The following objectives were formulated for the research:

- To examine the learner characteristics and background in a blended learning environment.
- To find out the levels of use and satisfaction with blended learning design features by learners.
- To identify the student characteristics/backgrounds and blended learning design features that significantly affect learning outcomes in blended learning.

This study was guided by three main research questions:

- What are the learner characteristics and background features in a blended learning environment.
- What is the level of use and satisfaction with the blended learning design features by learners in a designed blended learning environment?
- What are the student characteristics/background and blended learning design features significantly affecting learning outcomes in blended learning?

4 Research conceptual model of the present study

The literature indicates that student background and characteristics have to be taken into consideration in designing a blended learning environment. The design elements are crucial as they form the medium in which practical approaches to blended learning are realized. This study is therefore based on the following conceptual model where learners’ background and characteristics are examined in a blended learning design set up as they engage with technology to lead to learning outcomes in a transition from face-to-face to blended learning.

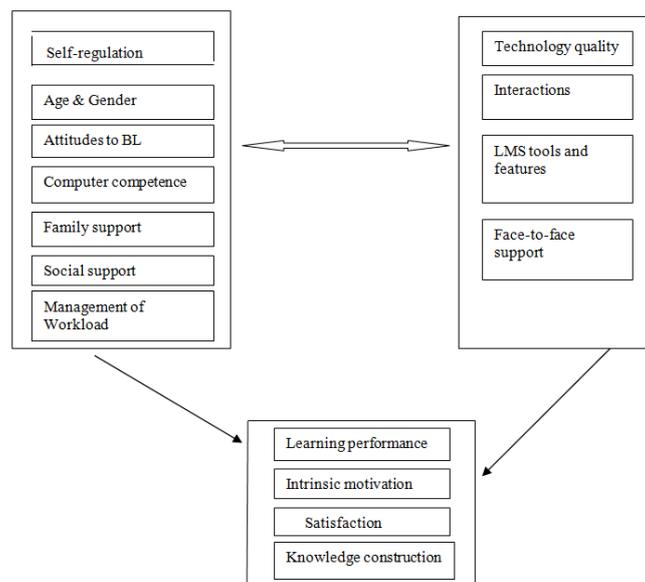


Figure 1: Conceptual model of this study

5 Method

5.1 Research design

This is a quantitative study in which we determine how student characteristics/background and design features of blended learning affect learning outcomes in a transition from face-to-face to a blended learning environment. The subjects of study have been measured once thus associations between the variables were investigated.

The study is based on a planning evaluation research design Guskey (2000) since the outcomes are aimed at evaluating the blended learning design. This is because of its strong link with practice and can develop more effective educational interventions (McKenney, Nieveen and Van den Akker 2006). We have employed an inductive research approach since the conceptual aspects have been derived from the literature to bring out generalizations in the design of blended learning. Tests have been carried out on the various concepts leading to the conclusions as illustrated in the results.

5.2 Participants

In the schools of Education (n=48) and Business and Management Studies (n=188), sophomore students were involved due to the fact that they have been introduced to ICT basics during their first year of study. Finalist students were used from The School of Informatics and Computing (n=18) since most of the year two courses had a lot of practical aspects. From the Postgraduate Directorate (n=16), first and second year students were selected because they were involved in blended learning approaches by paper-based modules. This brought the total number to 270 participants.

The study population comprised of 146 male students representing 54.1% and 124 females representing 45.9% with an average age of 24.6 years.

5.3 Instruments

Formative and summative evaluation results from the students were used to measure learning performance of different age groups and sexes in blended learning.

We applied the Online Self-regulated Learning Questionnaire (OSLQ) by Barnard et al (2009) for the students' self-regulatory learning skills in the learner characteristics measure. This was to establish the self-regulatory skills of learners as they undertook blended learning during the experiment. Sub-scales of goal setting, environment structuring, task strategies, time management, help-seeking and self-evaluation were used. We used the sub-scales to gather data on a five point Likert scale ranging from 1=strongly disagree to 5=strongly agree. We used the Intrinsic Motivation Inventory (IMI) by Deci and Ryan (1982) which assesses the interest of participants or enjoyment (6 out of 7 items), the perceived competence of the blended learning intervention (all 6 items), effort (all 5 items), pressure/tension (all 5 items), value/usefulness (4 out of the 7 items). The other scales of this study were self-developed.

5.3.1 Reliability of the instruments

Cronbach's alpha was used to test reliability and the table below gives the results. All the scales and sub-scales had good internal consistency reliabilities except the internet reliability sub-scale where one item was deleted to improve reliability to .75 from .45, the interaction sub-scale in the attitudes scale where the deletion of one item raised reliability to .64 from .41 and finally we deleted two items from the pressure/tension sub-scale in the intrinsic motivation scale to raise reliability to .69 from .36. The instruments were based on the outcome of the literature review that addressed elements which are an integral part of learning outcomes in blended learning.

Table 1: Reliability results for the scales and sub-scales

Measure	Scale	sub-scale	Cronbach's alpha	
BL design features	Online tools & resources	Usability	.854	
		Navigation	.824	
		Content	.866	
		Perceived usefulness	.829	
	Interactions	Student-student interactions	.799	
		Student-content interactions	.760	
		Student-teacher interactions	.803	
		Technology quality	Availability	.696
			Quality of materials	.754
	Internet reliability		.754	
	Student characteristics & Background	Self-regulation (based on OSLQ)	Moodle effectiveness	.740
			Face-to-face support	.706
			Goal setting	.857
			Environment structuring	.774
Attitudes towards BL		Task strategies	.724	
		Time management	.684	
		Help seeking	.633	
		Self evaluation	.784	
		Learner autonomy	.849	
		Quality of instructional methods	.802	
		Course structure	.717	
		Course interface	.784	
		Interaction	.639	
		Family support	.759	
Social support	.736			
Management of workload	.686			
Learning outcomes	Motivation (Based on IMI)	Interest & enjoyment in tasks	.672	
		Perceived competence	.674	
		Effort/importance	.738	
		Pressure/tension	.685	
		Value/usefulness	.820	
	Satisfaction	Instructor	.838	
		Course content	.766	
		Technology used	.789	
		Interactions	.819	
	Knowledge construction	Face-to-face sessions	.829	
		Initiation	.719	
		Discovery	.860	
		Accomplishment	.770	

5.4 Data analysis

Descriptive statistics were applied with cross-tabulations to establish the frequencies of the variables under measurement and demographic characteristics of the study population.

Regression analysis was done between the student variables and design elements with learner outcomes to determine the significant factors for learner outcomes in blended learning.

Independent t-test was applied to find out the differences between male and female students in grades obtained in blended learning. One-way ANOVA between subjects was conducted to establish if there were differences in performance between age groups of students. Normality tests were performed on the students' grade data to qualify them for parametric tests and the normality results are presented in table 2 below.

Table 2: Normality test results for the students' grade data

	Mean	Trimmed mean	Skewness	Kurtosis	Sig.
Grades	76.2	77.1	-0.82	1	0.00

Shapiro Wilk results qualified the use of parametric tests because there were no violations of the parametric assumptions found. The fact that significant values were found to be less than 0.05 could not necessarily disqualify the use of parametric tests (Pallant 2010). We therefore had to consider the results for skewness and Kurtosis that were found to be between -1.0 and +1.0 thereby indicating that the distribution was sufficiently normal to use parametric tests (Gray 2014). The selected methods have been applied elsewhere in other studies but for our case, they are applied with a new approach considering the design of blended learning in a different setting.

6 Results

6.1 Students' background and characteristics (RQ1)

6.1.1 ICT competence

As an important requirement for effectively engaging in blended learning, students' ICT competence, confidence and extent of usage were analyzed before the commencement of the study. Results show that they are competent enough in word processing (67%) and were confident (64%). They are however below average in e-mail packages (41.3%), spreadsheets (39%), web browsing (33%) and html tools (20%). In general, learners work with computers at an advanced level (80%), (Kintu & Zhu, 2015).

6.1.2 Self-regulation

Self-regulation practices were analyzed and results show that students exhibited good levels of self-regulation in blended learning with mean ranges of between 3.3 and 4 and standard deviation between 1.1 and .89 for the sub-scales of goal setting, environment structuring, task strategies, time management, help-seeking and self-evaluation.

6.1.3 Attitudes towards blended learning

The attitude of the learners towards blended learning was analyzed and results show that learners generally have positive attitudes towards aspects of blended learning. Mean and standard deviation ranges for the sub-scales of learner autonomy, quality of instructional materials, course structure, course interface and interactions range between 3.2 to 4 and .86 to 1 respectively.

6.1.4 Family support

The results for this show that learners get support from their respective families with mean values for the scale ranging from 3.2 to 3.8 and standard deviations between 1.0 and 1.3. However, there is little support in cases where learners face problems with computers and internet (M=2.8; SD=1.3).

5.1.5 Social support

Results show that there is support from the society towards learners in blended learning who do not feel isolation but community belonging as they learn. Only their reliance on peers showed a mean of 3.1 with standard deviation of 1.0.

6.1.5 Management of Workload

Learners who at the same time work have an enabling environment for a successful involvement in blended learning. Mean differences ranged from 3.6 to 4 with standard deviations between 1.1 and .83. The students' attention to their study was analyzed against the attention to other activities and results show that 26% of the learners spend less than three hours doing other activities that are not related to study, 24.3% spend three hours, 22.4% spend six hours, 14% spend eight hours while another 14% spend more than eight hours on other activities. The hours spent on other activities other than study interfere a lot with their concentration on learning (M=3.2; SD=1.1). They however take their own decisions on when to concentrate on other activities and when to study (M=3.7; SD=1.0). However, learners are always punctual in meeting deadlines in blended learning (M=3.9; SD=.86).

6.2 Involvement of learners and satisfaction with technology and blended learning design features in blended learning (RQ2).

6.2.1 The use of the LMS tools and features

An analysis of their usability, navigation, posted course content, and perceived usefulness was conducted. Results show that, to a large extent, learners made use of the tools and resources and perceived them as useful. The means of the items ranged from 3.0 to 4.2 with standard deviations between 1.8 and .80. There was however a low mean of 2.9 regarding posting challenges for peers' ideas online as part of online interactions. The use of Moodle was analyzed to determine the levels of use and learner satisfaction with it.

Table 3: Percentage of moodle feature use by learners (N=270)

Moodle feature/function	percentage use
Messaging	82
Search for materials	84
Calendar	53
Discussion forum	56
Posting to instructor	68
Downloading files	70
Uploading items	46
News	57
Login	88

Measure: Yes; No

The level of use as seen from table 3 above shows excellent utilization of messaging, searching for materials and logging into the system. Learners did well with the use of the calendar, forum discussion, posting work to the instructor, downloading files and the news forum. They were however below average with uploading items on the system. Their overall rating of Moodle usage to satisfy their learning requirements was satisfactory (M=3.5; SD=0.9) and they considered it effective in their learning (M=3.7; SD=0.9).

Table 4: Use of Moodle

Moodle aspect	With difficulty	Without difficulty	N=272
Logging in	37%	63%	266
Opening Moodle features	30%	70%	266
Internet connectivity & strength	55%	45%	266
Proper functioning	28%	72%	266

Measure: Yes; No

From table 4, majority of the learners did not find logging into the system, opening its features as difficult and Moodle functioning was good. The difficulty was however found by many learners in the internet connectivity and strength though it is not threatening as 45% of the learners did not find difficulties with it.

6.2.2 Face-to-face support

The use of face-to-face sessions by the learners in blended learning is good and they were generally satisfied with mean ranges between 4.3 and 4.0 and standard deviations between 0.7 and 0.9. Learners therefore prefer that face-to-face sessions continue in blended learning since they were satisfied with them.

Table 5: Student preferences for face-to-face session periods

F2f session period	Percentage	N=270
At the beginning of the semester	33	252
In the middle of the semester	12	252
At beginning, middle & end of the semester	46	252
At the beginning & end of the semester	10	252

Measure: 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly agree

Findings show that face-to-face sessions should take place at the beginning, in the middle and at the end of the semester.

6.2.3 Technology quality

The technology used during the blended learning intervention study was analyzed in regard to its availability, quality and reliability. Results show that learners were satisfied with the technology set up for the intervention study. Mean results in the items ranged from 3.1 to 4 with standard deviation ranging from 0.9 to 1.1.

6.2.4 Interactions

An analysis of learner interactions with peers, instructor and content showed that meaningful interactions occurred. Mean ranges were from 2.9 to 4.1 and standard deviation ranging from 0.9 to 1. Low means were a result of the lesser number of students posting challenges for peer’s ideas on-line

6.3 Factors predicting learning outcomes in a blended learning design (RQ3)

Performance

Students’ performance by age and gender

An independent samples t-test was conducted to compare the performance grades by male and female students. Results indicated that there is no significant difference in the performance of male students (M=65.1, SD=11.6) and female students (M=65.5, SD=10.5); $t(231)=-.286, p=.775$ (2-tailed). This shows that male and female students performed equally well in a blended learning environment design. A one-way between subjects ANOVA was also conducted to establish if there were differences between age categories of students in regard to their respective grades. Results indicate that there were no significant differences in performance between the three age groups i.e. young, middle aged and old at the $p>.05$ level for the three age groups $F(2,226)=1.372, p=.256$. This means that different age groups can perform equally well in blended learning.

Factors predicting blended learning outcomes

Regression analysis showing the significant factors predicting outcomes in blended learning was carried out. Regression results reflecting the significant factors of student characteristics and design elements towards learner outcomes are reported in table 6. Learner attitudes towards blended learning were found to be significant factors in learner satisfaction ($\beta=.11, t=1.22, p=.05$) and motivation ($\beta=.26, t=.26, p<.05$) though not significant in knowledge construction and performance. This is followed by management of workload ($\beta=.14, t=2.03, p<.05$). The students’ background in terms of their management of workload is a significant factor for knowledge construction ($\beta=.13, t=2.01, p<.05$). Among the blended learning design elements, learner interactions were found to be significant factors to learner satisfaction ($\beta=.23, t=2.42, p<.05$) and to knowledge

construction ($\beta=.21$, $t=2.12$, $p<.05$). As noted here, apart from learner attitudes being significant factors for satisfaction ($p<.05$), motivation ($p<.05$) and management of workload being a significant factor for learner satisfaction ($p<.05$), knowledge construction ($p<.05$), all the other learner characteristics and background are not significant factors for the respective learning outcomes. Furthermore, apart from interactions (in the design elements) being a significant factor for learner satisfaction ($p<.05$), all the other features are not significant factors for the respective learner outcomes ($p>.05$ for all the scales).

Table 6: Significant factors in learning outcomes in a blended learning environment

	satisfaction			motivation			knowledge construction			Performance		
	β	t	p	β	t	p	β	t	p	β	t	p
<i>Student characteristics</i>												
Attitudes to bl	.19	1.93	.055*	.26	2.60	.010*						
Management of workload	.14	2.03	.044*				.13	2.01	.046*			
<i>Design features</i>												
Interactions	.23	2.42	.016*				.21	2.12	.035*			

* $p<.05$, NB: Only significant factors

7 Discussion

7.1 The students' background and characteristics in a blended learning environment

In this study we have taken the learning outcomes as dependent variables to study the learner characteristics/background and design features that are significant for blended learning design, taking students from three out of five schools and one directorate as sample groups. The study suggests that to a great extent, student characteristics and background such as their attitudes towards blended learning and their management of their workload at work places are crucial for satisfaction and motivation as well as learner knowledge construction in blended learning. The good level of technology use is a big factor since it affirms ease of use in technological applications. Results on gender and age differences support previous findings that no differences exist in learning performance between ages and sexes in blended learning (Coldwel et al), though different from the findings by Reinen and Plomp (1993,1996 and 1997), Hoskins and Hoof (2005) and in line with this, Price (2006) found that female learners in online environments are always engaged and could out-perform their male colleagues. Learner background in terms of being supported by families and society members is important for blended learning design. It assures emotional enrichment and reduces anxiety in ICT usage (Bimber 2000). Working learners have all it takes for peer interactions as their workload at places of work does not inhibit participation in blended learning. The interference posed by other activities on study time could slow down learning progress as shown in the results but thanks to the fact that learners take their own decisions to do study or concentrate on other activities. This self-regulatory aspect makes blended learning feasible.

7.2 Involvement of learners and satisfaction with technology and blended learning design features in a blended learning environment.

Regarding our second research question, students' engagement in the use and application of the various resources in blended learning shows that there was good use of the features and learners were satisfied with them. Students satisfactorily used the learning management system (Moodle) to log in, post on the forum and submit their work through the system. As noted by Thomas (2002), the interactive practices by learners brought about good student engagement and led to critical analysis and knowledge construction by the learners. Some few interruptions in the internet connectivity were noted though this did not have an effect on the learners' completion of their on-line activities during the connection. This somehow agrees with Othman and Musa (2012) regarding internet access and speed as key to learner satisfaction in blended learning. The face-to-face support in blended learning is seen to be satisfactory and in line with Ranganathan et al's (2007) proposal, learners in this study were able to determine online and face-to-face proportions for the latter to be at the beginning, in the middle and at the end of a semester (supported by 46%) different from the format

used in this study which was face-to-face at first and at the end for review and final examinations supported by only ten percent of the respondents.

7.3 Learning outcomes and associated factors

There are very few factors associated with blended learning outcomes among the independent variables according to this study. Learner attitudes, management of workload and learner interactions were the only significant factors for learner satisfaction while management of workload and interactions are significant factors for knowledge construction in blended learning. The learners' positive attitudes are also a significant factor in their intrinsic motivation according to this study. None of the three variables (attitudes, management of workload and interactions) contributed to learning performance in terms of final grades in blended learning. This resulted from students spending more hours at work places which interfere with their concentration on learning and a lesser number of learners posing challenges to peers' ideas online, exchanging knowledge through Moodle and 44 percent of the learners not using the discussion forum. The variables including self-regulation, family and social support, technology quality, online tools and resources as well as face-to-face support are not significant factors for learning performance. We note that some of the items under self-regulation and learner attitudes scored means below 3.5 which reduced these variables in regard to becoming a significant factor in some of the learning outcomes. Tangible support from family towards learners in blended environments has been found to be crucial (Jacobson 1996). The failure of this variable as a significant factor in learning outcomes is thus attributed to low mean scores on learners getting assistance from family to get over internet problems according to this study. Research has shown that the quality of technology and internet do affect learner satisfaction (Piccoli et al., 2001). Generally, if there is high quality and reliability in IT, there is meant to be some high learning effects in blended learning (Hiltz 1993). In this study, internet reliability means of 3.1 and the fact that about 37percent of the students found difficulty in logging in Moodle and 55percent reported difficulties with internet connectivity and strength may have accounted for technology quality and online tools not being factors in learning outcomes of satisfaction, intrinsic motivation, knowledge construction and performance.

Despite the failure of some variables to show as significant factors to blended learning outcomes, learners showed a high affinity to engage in blended learning; which accounts for learner attitudes being contributors to learner satisfaction and intrinsic motivation. In the same vein, knowledge construction is highly exhibited and significant factors in this include learner interactions and management of workload. Interactions have been found to be predictors of learner satisfaction as this study has confirmed (Kuo et al 2013) and Wu, Tennyson and Hsia (2010) also named interactions among the primary determinants of student learning with blended e-learning systems.

8 Conclusion and recommendations

The reviewed literature indicates that the learner characteristics and backgrounds are strong factors worth considering in the design of blended learning environments and so are the design elements of blended learning. The findings here confirm the importance of these elements and further indicate the significant factors that are predictors of learning outcomes in blended learning among the elements. It is further noted that gender and age are factors that pose no setback on learner performance in blended learning.

This study recommends that blended learning design should take into consideration the various learner characteristics and examine the ability of learners to make use of and interact with learning management systems for successful blended learning undertakings. More designs can be done to establish other learner characteristics for blended learning and find out other factors that predict learning outcomes for successful designs. Such factors could be instructional methods, learning styles institutional readiness and student capabilities.

9 Limitations and implications for blended learning design

This study has not dealt with all the learner characteristics in a blended learning design environment and neither have all the design features been examined. The choice of specific age categories was not made by a systematic sampling procedure but was got from the filled demographics section of the questionnaire. Therefore, the category of elder learners did not have a sufficient representation. Follow up focus group interviews were not possible due to logistical, procedural and administrative setbacks. Such interviews would have given useful qualitative information regarding learner experiences with a blended learning intervention and would therefore have added to our answers to research question three. Learner outcomes could have

been influenced by quite a number of other factors not tackled in this study. It was also not possible to convincingly explain why many of our independent variables did not significantly contribute to the learning outcomes. Future studies could tackle other social and possibly economic variables that could be additional factors in the design of blended learning environments.

The study nonetheless provides a clear cut procedure for designing instructional technology. On the whole, insights gained from this study can be useful in regard to studying learner characteristics and background in the design of instructional technology for rural settings. Technology in its infancy should be taken on for teaching and learning but a lot of care needs to be given to empowering the users with skills to enable the ease of use.

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