

A Scalable Distance Learning Support Framework for South Africa: Applying the Interaction Equivalency Theorem

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ABSTRACT

This study constructs a framework for scalable learning support in the distance education sector in South Africa by drawing on Anderson's Interaction Equivalency Theorem as point of departure. It is argued that the limited or no face-to-face interaction in distance education needs to be overcome by providing meaningful learning support. The issue of scalability, as one of the drivers of this study, was necessitated by the fact that distance education is vested in the private sector in South Africa, which implies that the manner in which providers' approach learning support needs to answer to the requirements of scalability and affordability. The Interaction Equivalency Theorem, which posits that one or two high level modes of learning interaction can be equated to all three modes, is used as theoretical base for this design-based research approach. A sequential explanatory mixed methods approach was followed by employing both qualitative and quantitative methods to explore the needs and preferences of the learners and facilitators of a large distance education company in South Africa. The data accumulated, revealed that the focus of learning support should be related to *content, and facilitation*, while acknowledging the need for some personal advice and guidance. To ensure the scalability of support interventions, a distance education provider should consider which interventions should take precedence and which should be outsourced, technologically driven or provided in-house. This paper presents a framework to be used by private providers to support learning, and makes a theoretical, practical and educational contribution to the field of distance education.

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INTRODUCTION

In light of the Global Development Goals, distance education can serve as a catalyst for social, economic and sustainable development due to its flexibility, accessibility and its potential to accommodate learners with diverse learning needs in the basic education phase. However, learners receiving their education through the distance education mode of delivery, tend not to fare as well as required. This issue of under-performance by distance education learners in the basic education phase is in line with trends in higher education where student attrition and underperformance is a common phenomenon. Studies performed by Morgan and Tam (2006) and Simpson (2013) addressed the problematic nature of student performance through distance education. Simpson's study (2013) of the UK Open University revealed that the graduation rate is about one-quarter less than at conventional universities. In the South African school education context the National Senior Certificate is a good example. The independent examination board in South Africa with the largest number of distance education learners, had an initial pass rate of about ten percent lower than the pass rate of public schools (before the supplementary examinations) (SACAI, 2016).

The difference in the performance of learners necessitates the interrogation of the main differences between the learning modes followed in schools and that of distance education. The primary difference is the interactive or non-interactive relationship between learner and facilitator. Azevedo, Moos, Greene, Winters and Cromley (2008: 61) found a significant increase in understanding among learners when interaction with an expert tutor takes place. Distance education learners do not have the novelty of having access to an expert human tutor or teacher on a continuous base. The absence of this learner-facilitator relationship (teachers, tutors and parents will hence be termed facilitators) poses challenges to providers of distance education to find ways of ensuring quality education and optimising learner success.

The rapid growth of MOOCs (Massive Open Online Courses) in higher education provides evidence that the open learning modes of education are flourishing and not merely become an option for economically and socially disadvantaged people (Zuhairi, Zubaidah & Daryono, 2008: 7-9). However, in South Africa, distance education at school level is not nearly as developed as in some highly populous countries, such as Indonesia, Mexico, China, Pakistan and Brazil. The national Department of Basic Education in South Africa does not cater for any distance education as the governments do in the countries mentioned above, which results in a gap in the national education provision system. In South Africa this gap is currently filled by the private sector.

In illustrating a typical South African case, a brief overview of the South African context needs to be provided. The South African Schools Act (RSA, Act no 84 of 1996) provides for compulsory education at school (section 2) or at home (section 51) until such "*learner* reaches the age of fifteen years or the ninth *grade*, whichever occurs first (section 3(1)). Grades ten

to twelve constitute the final phase of the basic education phase, although not compulsory. In passing Grade 12, learners are awarded the National Senior Certificate and it is particularly during this phase, that distance education modes are becoming increasingly popular.

A number of private distance education providers exist for learners during the schooling phase. All those providers are private institutions that contribute to the learning experience of learners who do not attend school. Some of the major providers in the sector are Impak, Brainline, Clonard, Love2Learn and Virtual Schools. Impak is South Africa's largest provider of distance education for learners in the "schooling phase in South Africa and currently has 14 000 registered learners. Impak follows the national curriculum and provides study material and facilitator's guides (hard copy and e-books), as well as assessments (encrypted on a secure portal), a system for recording marks, marking of assessment tasks and support services to learners and facilitators by subject experts. Currently Impak is growing at a rate of 35% to 40% per year, implying that certain services need to be provided in a more scalable manner, resulting in this piece of research to identify options in support of learning to perform well. Impak also serves as the case to be investigated for the purpose of this paper.

South African educationalists are, therefore, challenged to investigate how such private distance education companies can approach their task as there are no research conducted on providing learning support to distance education learners in South Africa. Such research needs to be approached from both an educational and a business perspective to (a) provide a comprehensive and effective learning solution, and (b) to achieve business scalability as those providers are private companies.

PROBLEM QUESTION AND PURPOSE

The distance education sector acknowledges that this mode of delivery has to compensate for the lack or limited face-to-face facilitation for enhancing effective learning. Some decades ago the seminal work of Daniel and Marquis (1979) particularly challenged distance educators to balance independent, interactive and activity-centred learning. This paper addresses that challenge and poses the question: *How can distance education learners best be supported to optimise learning in ways that make business sense?*

Anderson (2003(a) & (b)) and Anderson and Garrison (1998) went public by suggesting the Interaction Equivalency Theorem as an option to render support in enhancing learning in a cost-effective way. This theorem, in brief, means that if "any one or two of (1) *learner-learner*¹, (2) *learner¹-facilitator* or (3) *learner¹-content* interaction is of a high quality, the other one or two can be reduced or even eliminated without impairing the learning experience", which in turn has cost-saving implications for distance education providers. The purpose of this paper is therefore to suggest a framework for scalable learning support in distance education by using Anderson's Interaction Equivalency Theorem as point of departure.

¹ Anderson used the term Student, but it is changed to Learner for the purpose of this paper.

THEORETICAL FRAMEWORK

As context for designing of a scalable learning support framework, it is necessary to interrogate the concept distance education. Distance education is termed in definitions as “teachers and students being in different places for most of the learning time” and “open access to learning” (Moore & Kearsley 2012: 2), “education of people who are not always physically present at a school”, “studying at a pace of their choice, learning without constant face to face contact with a facilitator” (Bates, 2008:2), and “creating a flexible learning environment” (Menchaca, 2008:232). The descriptions above indicate limited face-to-face contact and flexibility, which bring with them particular challenges to be addressed in terms of how learners can be supported to perform optimally.

When distance education providers have to approach this learning support issue, they have to address both the educational and the business side of the interventions, by viewing:

- the Interaction Equivalency Theorem as theoretical and educational base for a learning support framework in the distance education sector, and
- the fundamentals of scalability of interventions in distance education business context.

Interaction Equivalency Theorem

The distinct work of Sims (1999:257) refers to interaction in the learning process as being “various forms of participation and communication” that contribute in making learning meaningful. However, such forms of interaction become a challenge when learning takes place by means of a distance mode of delivery because of the absence of or limited face-to-face (learner-facilitator or learner-learner) interaction.

Interaction has always been a critical component in the learning process, which was even acknowledged by John Dewey a hundred years ago. Some other fundamental work on the necessity of interaction in the learning process, and particularly in distance education, are that of Moore (1998, 2001) and Bouhnik and Tali (2006). Moore (1998:3) initially elaborated on the three forms of interaction by using interaction with content, interaction with the instructor and interaction with other learners as foundation. Moore (2001) later extended his categories to include ‘interaction with the system’ in light of the advancement of technology in the education arena. Bouhnik and Tali (2006) also used the learning pyramid to demonstrate the various forms of interaction, but extended the model by including Moore’s ‘system interaction’ as part of the learning environment. In view of the above developments in terms of the interaction theory, this paper will use an adapted model as shown in Figure 1 below as point of departure.

The above model is evident of the complicated nature of the coherence between, *learner-learner*, *learner-facilitator* and *learner-content* within a particular learning context (such as distance education) and system (such as the availability of technological tools and devices), as well as the interaction within each of the components (such as learners with other learners). In his research, Anderson (2003:131) has been polling learners in distance education and found that a strong desire for different modes of education and activities exist. He also refers to the pressure and opportunities to enhance all these forms of interaction through the “development of programming tools and environments” (p. 132).

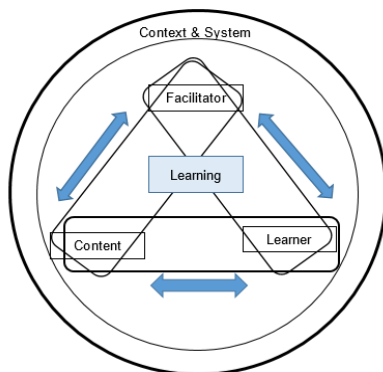


Figure 1. Modes of Interaction in Distance Education (adapted from Anderson & Garrison (1998), Anderson (2003), Moore (1998 & 2001) and Bouhnik & Tali (2006))

Anderson (2003) posits his Interaction Equivalency Theorem as follows: *Deep and meaningful formal learning is supported as long as one of the three forms of interaction (learner–teacher¹; learner–learner; learner–content) is at a high level. The other one or two may be offered at minimal levels, or even eliminated, without degrading the educational experience. This implies that high levels of one or more than one of these three modes will likely provide a more satisfying learning experience.*

The theorem therefore implies that a distance education provider can decide to focus on only one or two of these forms of interaction, as long as those forms are of such good quality that they will be equivalent to the one or two forms omitted.

Scalability

In view of the growing distance education market, as indicated earlier, distance education providers in South Africa need to be strategic in terms of growing the business without losing those core elements that have brought the business to where it is. Following a scalable mode of thought, businesses need to grow without forfeiting quality. Dudnik (2010: np) aptly explained scalability as “developing products or services that people want, and figuring out how to produce many of them for lower costs, while selling more of them.”

Sutton and Rao (2014), after examining over 400 companies in the USA, emphasised that it is important to take time to do things right and to ensure that decisions are made in line with the needs of the market. According to this extensive research it seems as if businesses need to adopt a forward-thinking mind-set when they consider scalable options and not fall into the trap of incorporating a maze of systems without doing their research to identify the detail and the clients’ needs. With regard to the need for research Botha (2010:2), Harley (2011:214) and Kizito (2016:20) emphasised the shortage of African-grounded research in business scalability, which contributes to the need for this research paper.

In addressing the quest for scalability in distance education provision, the application of technologies seems to be the best option to consider. Moore and Kearsley (2012) contributed to the provision of scalable education by emphasising that learners have to be assisted in

some or other way and recommend technological tools. However, it is important to think pro-actively when considering financially viable options. as distance education institutions may put too much focus on the provision of learning material and technology and too little on getting the learners to learn (Simpson, 2013) Anderson (2011) also contributed to the debate on the improvement of learning by stressing the potential value of specialised delivery through technology as it provides efficient and timely access to learning material. He also warns that technologies are merely vehicles to deliver education and can be a waste of financial resources if it is not tailored according to the needs of the learners and if operational constraints such as internet access and bandwidth are not accounted for.

In accordance to the above discussion on a sound theoretical base and the value of considering scalable options in line with client needs, this paper is an attempt to, not only gain an understanding of the needs of distance education users in the schooling phase, but also to contribute to African-grounded research by using a South African case as data source.

METHODS

The three conceptual domains of the Interaction Equivalency Theorem, learner-learner, learner-facilitator and learner-content within a distance education context, assisted by technological tools and devices, were used to drive the empirical investigation.

Design-based research is used to develop a framework for scalable distance learning support (Brown, 1992; Cresswell, Plano Clark, Gutman, & Hanson, 2003). Brown (1992) originally perceived design-based research as a way of changing theory into practice. Lagemann (2002) extended upon Brown's views by regarding it as valuable to create "usable knowledge". In this study, the recommendations of Wang and Hannafin (2002:8) to use multiple methods, such as quantitative and qualitative methods, were used to enhance the "credibility" of this design-based research project, therefore a sequential explanatory mixed methods approach was used. The data gathering took place in a number of phases, as explained in figure 2.

During the first phase, the Interaction Equivalency Theorem was identified as a possible theoretical foundation upon which the support framework could be built. Thereafter, the fourteen subject specialists at Impak had to list the support requests they had to deal with over a period of five months. The latter data was combined with the data sheets kept by the five Client Relationship Officers on the type of requests they receive when dealing with learners and facilitators (either parents or tutors) to construct a structured battery of 25 questions. The questions focussed on the type of learning support required, as well as exploring the need for a number of support options. A 5-point Likert scale (5 = Very much; 4 = To a large extent; 3 = Average; 2 = not much and 1 = Not at all) was used. The questions can be categorised according to each of the three components of the Theorem, targeting the two target groups; learners and facilitators (parents, teachers or tutors).

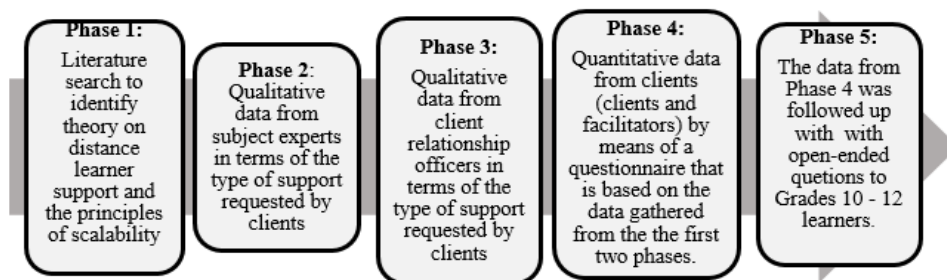


Figure 2. Phases of data gathering

One hundred potential respondents (50 from each target group) of Impak's Grade 10- 12 learners and facilitators (parents or tutors) were randomly selected and invited via electronic mail to participate. The survey was constructed by using the Survey Monkey questionnaire construction tool. Sixty-eight responses were received back (27 learners and 41 facilitators = 68% response rate) and the data was analysed to identify the areas in which the greatest support needs exist, as well as the most suited options to address those needs. In analysing the data (end of phase 4), descriptive data was generated by determining (1) the mean scores (2) standard deviations and (3) significance of the difference in the two groups of means (*p-value*). To conduct the t-test the two-sample unequal variance test was used. A Cronbach's Alpha of 0,93 was achieved, indicating a high level of reliability. The data was analysed by using SPSS version 22.0.0.0.

The survey was followed-up by a semi-structured qualitative investigation by which a number of the elements that emerged from the survey, were explored further. Open-ended questions were emailed to ten Grade 12, ten Grade 11 and five Grade 10 learners. The twenty-five learners were conveniently selected on grounds of their academic performance. Only learners with an above 70% average were invited to participate of which fourteen learners agreed to give their opinions

RESULTS AND FINDINGS

During Phases 2 and 3 of data-gathering, support in terms of subject content, subject choices, concept explanations, examination guidelines, year programmes and the pacing of work were identified. The areas in need of support and possible options to address those needs were converted into questions to determine the needs and preferences of the learners and the facilitators. The mean scores were used to identify ten of the 25 areas in which the greatest needs for interaction and support exist. Scalability and affordability are issues to consider, therefore, this paper only focusses on the most pertinent areas, as a distance education company has to strategically plan for the required development. For such development it is also necessary to gain insight into the needs of the two target groups and whether there are significant differences in the support that needs to be provided to the different groups.

From Table 1 it is evident that the greatest need is the availability of online content enrichment (4.5), followed by the accessibility of tutors (4.34), having virtual tutors explaining

difficult concepts (4.3), material enabling independent learning (4.27), accessing advice on subject choices, university entrance and career opportunities (4.15), the availability of education specialists (4.12), online lessons (4.02), day-to-day guidance through the year's work (4.0), examinations tips and guidelines (3.97), as well as daily virtual tutorials (3.67).

Table 1: Ranking of variables, means and p-values (N=68)

Rank	Description of need	Mean: (N=68)	SDev	Mean: Learners (N=27)	Mean: Facilitators (N=27)	p-value (learners vs facilitators)
1	Additional online content enrichment (such as video clips and MS PowerPoint presentations).	4.5	0.42	4.54	4.46	0,528
2	A tutor who is available online during the day and after hours.	4.34	0.53	4.3	4.38	0,266
3	A virtual tutor to explain difficult concepts.	4.3	0.89	4,23	4.37	0,889
4	Material that enables independent learning.	4.27	0.77	4.2	4.34	0,396
5	Advice on subject choices, university entrance and career opportunities.	4.15	1.23	4.5	3.8	0,006**
6	Education specialists as currently practised.	4.12	0.91	3.8	4.44	0,005**
7	Online lessons.	4.02	0.83	4.2	3.84	0,001**
8	Day-to-day guidance through the year's work.	4.0	1.06	3.4	4.6	0,0003**
9	Examinations tips and guidelines just before the examinations.	3.97	0.67	4.1	3.84	0,012*
10	Daily virtual tutorials	3.67	0.89	4.15	3.3	0,006**

*p<0.05; **p<0.01

The variables, advice on subject choices, university passes and career opportunities, the availability of education specialists, online lessons, day-to-day guidance through the year's work, daily virtual tutorials (p<0.01) and the need for examination guidelines and tips (p<0.01) showed significant differences in terms of the needs of learners in comparison to the needs of facilitators.

Table 2 indicates the themes that emerged from the qualitative data analysis. The availability of support and tutors on request, the need for additional content, career and subject choice advice and the use of technology for lessons, explanations and online learning, concur to a great extent with the findings in next table.

Table 2. Patterns emerging from qualitative data

Themes emerging	Examples of qualitative responses
Learning support available on request (facilitator-learner connection)	<ul style="list-style-type: none"> • I mostly study at night and during weekends and then I need help. • I don't want to wait for Impak's subject expert to respond on my e-mail.
Access to tutors (facilitator-learner connection)	<ul style="list-style-type: none"> • Places where I can go for help. • Someone to help me when I get stuck. • Somebody to explain the things that I do not understand. • It is good to know that the subject experts can help when I am stuck.
Enriched content (content-learner)	<ul style="list-style-type: none"> • I'd like to get more background to certain parts of the content so that I can get the bigger picture to understand the work. • Please, make the content "alive". It is easier to remember.
Advice on careers and subject choices (facilitator-learner connection)	<ul style="list-style-type: none"> • We need more vocational options. • I would like to get more advice on subject choices. • Somebody needs to give me advice to prepare for my future.
Online/virtual lessons and explanations (content-learner connection)	<ul style="list-style-type: none"> • Please, creative, innovative online presentations – not tutors just talking about the work. • I'd like to see how things work, especially where there are practical applications.
Use of technology and online learning (facilitator-learner connection)	<ul style="list-style-type: none"> • What about smart phone or tablet apps to help us learn? • More detailed step-by-step guidance to take us through the work. If we can load these steps for all subjects on the computer, it will be much easier to work with, than having them separately for every subject. • Can't the subject specialists provide us with some tips and information to help us prepare for the examinations?

The theory and qualitative and quantitative data will hence be integrated to construct the intended distance learning support framework

DISCUSSION AND IMPLICATIONS

As the purpose of this article was to construct a distance education learning support framework, the investigation addressed both practical and theoretical concerns regarding the design of a scalable learning support system in the distance education sector of South Africa. In the absence of significant face-to-face interaction in distance education (Bates, Anderson & Moore XX), providers are compelled to provide learning support in ways that will address the needs and expectation of the learners (Anderson & Dron, 2011), as well as contribute to quality education in South Africa. As distance education in South Africa is vested in the private sector, support needs to be provided in an affordable and scalable manner. A workable framework will enable

distance education providers to be forward-thinking (Sutton & Rao, 2014), as such a design-based research framework does not only embody the needs of the clients, but also provides usable knowledge (Lagemann, 2002) as base of future decisions and developments.

Based on the data that was accumulated, the two areas that emerged - the need for stimulating content and some extent of facilitation - confirmed the need for two of the components as expressed in the Theorem (Anderson, 2003(a) & (b) and Anderson & Garrison, 1998). Further, the data also showed a need for some personal advice. Additional online content enrichment and material that enables independent learning are aspects that should be prioritised by distance education providers. One of the participants expressed the need for content enrichments in the following words, *“I’d like to see how things work, especially where there are practical applications”*. According to Anderson (2011:48) “effective learning does not happen in a content-vacuum”, which aligns with the need of the target group to have access to material that would enhance their learning experience and would motivate them to learn.

The findings of the study also confirmed the value of facilitation, as reflected in the Interaction Equivalency Theorem, implying that distance education providers need to consider forms of facilitation to replace traditional “face-to-face” interaction between learners and facilitators. This complements the research of Moore (1998, 2001), Bouhnik and Tali (2006) and Schmeck (2013) which addresses the contribution of the teacher or facilitator to the learning process. Distance education providers need to understand that support during office hours do not sufficiently address the needs of distance education learners. The participants in this research were clear on the fact that they need a tutor who is available online during the day and after hours. There is also a need for a virtual tutor, daily tutorials and on-line lessons to provide them with the necessary understanding of the content. One of the participants articulated this need for assistance as the necessity to have *“someone to help me when I get stuck”*. The participants view technology as an option to get access to knowledge and for their own learning. An online tutor platform could be a viable option to cater for the learners’ needs for guidance. There are a variety of technology-driven options in the educational market, which could be integrated into the learning experience. In support of innovative tools, one of the participants asked, *“What about smart phone or tablet apps to help us learn?”* Such technological applications can contribute to the scalability of provision as many learners can be served by such systems.

It is notable that the findings revealed a need for the continuation of the current subject specialists. Because their focus is the compilation of the study material that allows for independent learning, extending the facilitator’s guides and setting assessments, they are knowledgeable about the content and can provide valuable assistance. They are then also the most suitable people to prepare guidelines for examinations, develop step-by-step online guides, plan for the enrichment of the content, and the development of virtual explanations and online lessons. This part of the education provision needs human expertise and scalability is a challenge. Even the need of career and subject choice advice can be outsourced to an educational psychologist who are remunerated on an hourly-base or the usage of online tools to assist learners with conducting intelligence, aptitude and achievement tests to assist with subject and career choices. These type of enquiries are seasonal in nature, implying that they occur mainly at the start of or towards the end of the academic year.

In consolidating the above data with the theory from the Interaction Equivalency Theorem

(one or two of the components at a high level), the framework in Figure 3 emerged in which the aspects in italics represent the aspects that can be either provided online or outsourced to ensure scalability.

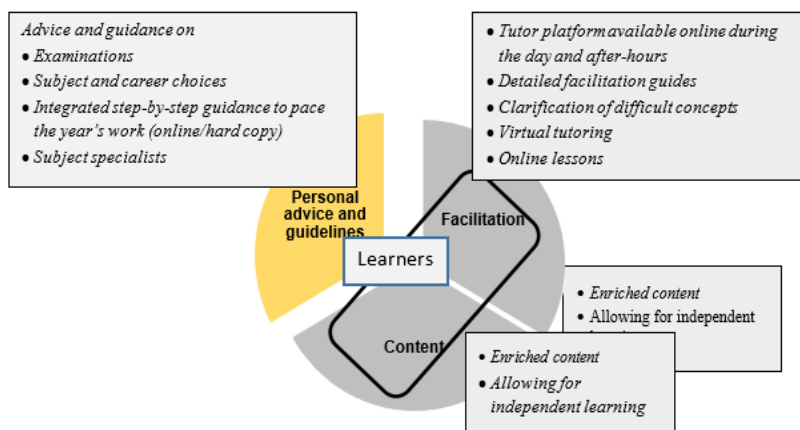


Figure 3: A scalable learning support framework for distance education in the schooling phase

Providers also need to take cognisance of the differences in the needs of the learners and those of the facilitators (tutors, parents), who might be involved in the learning of the distance education learners. Advice on subject choices, university passes and career opportunities, online lessons, examinations tips and guidelines, as well as virtual tutorials are rated higher by the learners than by the facilitators. However, it seems as if the facilitators have a greater need for the day-to-day planning and the assistance of the subject specialists as indicated in the items ranked 5 – 10 in Table 1 above. The differences in the needs of the groups should guide distance education providers in tailoring support initiatives to address the wants of the two groups.

CONCLUSION

This study investigated the needs for support to optimise learning through the distance mode of delivery. To achieve the purpose of this paper a framework for scalable learning support in distance education was developed by means of a design-based research approach. The Interaction Equivalency Theorem (Figure 1) (Anderson, 2003(a) & (b) and Anderson & Garrison, 1998) was used as baseline theory for the design. The value of design-based research is that a mere theory becomes usable knowledge as the theory becomes infused with data from the investigations. The quantitative data that emerged from learners and part-time facilitators of the largest distance education provider in South Africa showed significant resemblance to the qualitative data from the learners and both sets of data supported the domains depicted by the Interaction Equivalency Theorem.

The Theorem, that deep and meaningful formal learning is supported as long as one or two of the three forms of interaction (learner–facilitator; learner-learner; learner-content) is at a high level, has been found to be valid if the findings of this research is viewed. The

findings revealed a need for the *learner-facilitator* and *learner-content* interaction and distance education providers need to attend to the areas which have been identified. To extend the learner-facilitator interaction does not necessarily imply “facilitation” in face-to-face format, but interaction through a variety of modes: particularly modes of delivery that have the potential to be scalable as distance education is provided by private enterprises in South Africa.

The providers of distance education can further consider which support interventions, as indicated in Figure 3, should be outsourced, delivered through technological applications or online or even provided in-house. Online tutor platforms to obtain subject support when needed, online lessons, virtual tutoring and explanations, as well as the provision of enriched content and facilitator’s guides constitute the aspects that can be provided in a scalable manner. Though the initial financial layout may be extensive, it will be a good investment, as such modes will be able to serve a very large number of learners, while saving on permanent staff costs. Technological tools and systems remain more affordable in comparison to the cost of human labour. The advice and guidance also needed by the participants should not be neglected when planning the support interventions.

The scalable learning support framework for distance education (Figure 3) that was designed in this study makes a *theoretical contribution* to the body of knowledge on distance education. In the context of the development of a scalable support system this research also *practically* contributes to the functioning of the sector, as there is a lack of any research on this particular topic in South Africa. *Educationally*, support to enhance learner achievement, the findings of this study could further contribute to realising the Global Millennium Goals, by which South Africa has to optimise all avenues of education provision in an affordable manner.

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