

RESEARCH ARTICLE

Design-Based Research (DBR) as an Effective Tool to Create Context-Sensitive and Data-Informed Student Success Initiatives

Ilse Karsten* & André van Zyl**

Abstract

Sub-Saharan Africa has the lowest higher education (HE) participation rate of any region in the world at under 10%. Large numbers of students are entering the various systems, often from non-traditional backgrounds, which contributes to making an already difficult transition even more difficult. In many instances, well-intended interventions and initiatives are imported from elsewhere or based on “common sense”, but they are often not very effective. This raises a crucial question: How can institutions best devise context-sensitive and effective student assistance programmes? Design-based research (DBR) uses an iterative and longitudinal process that involves theory, participant inputs, peer inputs and stakeholder inputs to cyclically develop theoretically informed, contextually sensitive and appropriate interventions. Most practitioners could benefit from a better understanding of this process when designing interventions. This article elucidates DBR as a phased intervention-development process aimed at assisting students to integrate into HE and focuses primarily on the methodological approach on which it elaborates using examples from a PhD study.

Keywords

contextual intervention, design-based research, student integration, first-year students

Introduction

There is an interrelated web of issues relating to student academic success and social mobility. In the South African context, Maluleke (2018) has, for example, pointed out that a strong relationship exists between a person’s level of education, and their social mobility and prosperity. Lower levels of socio-economic status are often linked in “contours” with other negative implications such as poor access to the health services availability, and quality (Van Zyl, 2016, p.1). Universities are key to addressing these issues and have been called the “engine rooms” for developing the human resources required to support and grow the South African economy (USAf, 2018a, p. 12).

* Ilse Karsten is a lecturer in the Department of Accountancy at the University of Johannesburg, South Africa. ORCID ID: 0000-0001-5704-9719. Email: Ikarsten@uj.ac.za

** André van Zyl is the Director of the Academic Development Centre at the University of Johannesburg, South Africa. ORCID ID: 0000-0002-9568-1667. Email: andrevz@uj.ac.za

Not only does Maluleke (2018) point out that students emanating from poorer households have much lower levels of HE participation than those from the higher socio-economic strata, they also often leave school under-prepared for HE (StatsSA, 2019). In sub-Saharan Africa, the participation rate of 17-to-24-year-olds is still below 10% (Ilie & Rose, 2016) and in South Africa it varies between 17 and 18 % (DHET, 2013). Student success and graduation rates across South African HE have shown some meaningful improvements over time. However, massive human and financial losses are still being incurred because of poor levels of student success (DHET, 2020).

The challenge of developing effective and data-informed interventions

The South African HE sector has spent huge amounts of money and massive effort aimed at improving student success. These efforts have borne some fruit but have not always been effective. Crisp et al. (2009) identify some of the reasons for lower-than-expected impact, linking it to unrealistic student expectations, unfriendly institutional cultures, and unwarranted assumptions made by institutions when planning interventions. Coates and Radloff (2017) exhort institutions of higher learning to transcend their preconceptions, as these tend to limit their thinking in ways that are detrimental to student success. When institutions and their representatives make invalid assumptions about their students and their needs, they often provide well-intended, but largely ineffectual interventions. Waage et al. (2015, p. 252) emphasise that developmental decisions should not be taken by the “unaccountable few”; but suggest that decisions related to interventions should be characterized by “deliberation, participation, and transparency of decision making”.

Interventions aimed at improving student success should therefore be designed using a collaborative and data-informed process. Fennie et al. (2020) emphasise the need for “evidence-informed” programs, especially for entry-level students. USAf (2018b) argues that understanding the attributes and experiences of South African students is key to improving their success. Improved student success must be the result of design and cannot be left to chance. Therefore, interventions should equally and strongly be based on a rigorous methodology and sound evidence. Design-based research (DBR) provides a productive framework that allows a move towards more data-informed and holistic interventions.

DBR as data-informed intervention creation methodology

DBR is often called an interventionist approach, since it aims to implement a strategy or bring about some change to address an identified problem (Ford et al., 2017). DBR is also known for its collaborative nature (Scott et al., 2020), which is why, when interventions are planned, a complex web of stakeholders are involved in the content creation and roll out of interventions. It therefore provides a comprehensive, collaborative, respectful and longitudinal developmental method which can be productively used to develop appropriate interventions that are data informed and contextually sensitive (Ford et al., 2017).

DBR is often used in educational contexts due to its focus on solving practical, real-world problems in everyday life (Ford et al., 2017). In the case study used to illustrate the methodology in this article, the DBR process was used to develop and implement an intervention to facilitate first-year student integration at a South African university for a selected group of students. These students were carefully selected to receive student bursaries by adhering to the criteria of coming from a previously disadvantaged background, belonging to a low socio-economic status, showing interest in accounting as career choice, and exhibiting the potential to succeed in the academic qualification. The intervention was implemented to three cohorts of 50 students each, in 2015, 2016 and 2017. The rest of this article comprises a detailed explanation of the DBR methodology and the authors reflect on its use and effectiveness.

Design-Based Research

DBR is a relatively new methodology (Anderson & Shattuck, 2012; Plomp, 2013) and has been identified as a good option to use in educational contexts due to its focus on solving practical everyday problems through a comprehensively designed intervention (Fransman, 2014; McKenney & Reeves, 2012; Plomp, 2007; Van den Akker et al., 2006). DBR typically follows an iterative process (Armstrong et al., 2020), where an initial, well-researched solution to the identified problem (called a prototype) is implemented. Feedback from the participants is then used to improve the solution (next prototype) and it is implemented again. This process is repeated until new feedback from participants is minimal, and the final prototype is then presented as the proposed intervention (Nieveen & Folmer, 2013). Recent examples of where DBR has been used include developing a framework for designing mobile virtual reality learning environments (Cochrane et al., 2017); developing clinical reasoning when working with virtual patients (Hege et al., 2017); improving infection control and prevention processes (Meyers et al., 2018); and making the connection between theory and practice explicit (Wolcott et al., 2019). The comprehensive nature of DBR and the time it takes to implement the process have been found to discourage some researchers and practitioners from using it. We argue, however, that alternative short-term research often results in an overly pragmatic approach that is not sufficiently context-sensitive or comprehensively designed.

Methodology – design-based research

DBR is typically characterized by recurrent versions of proposed designs in real-world situations where the researcher often fulfils multiple roles, whilst being mindful not to influence variables and outcomes. According to Barab and Squire (2004, p. 2), the *design* in design-based research refers to “a series of approaches, with the intent of producing new theories, artefacts, and practices that account for and potentially impact learning and teaching in naturalistic settings”.

Characteristics of design-based research

The five most prominent characteristics of the DBR methodology are described below. They foster and enable the context-sensitive and comprehensive nature of DBR-developed interventions.

a. DBR pursues practical solutions to complex problems

DBR aims, within a given context, to produce *knowledge* with *practical* relevance (Flick, 2007, p. 6; Plomp, 2007, p. 9; Plomp, 2013, p. 20; Van den Akker et al., 2006, p. 4). Outcomes are intended to be user-friendly for similar future situations, where minor adjustments can be made to satisfy relevant contextual needs. Therefore, DBR is not only data-informed, but it also creates theory and/or artefact. It has a potential multiplying effect in that it allows others to build on what has already been done instead of starting from scratch. In this study a solution was sought to support the HE integration process of students from a low socio-economic status.

b. DBR makes use of a research team

Most authors and experienced DBR researchers recommend the employment of a research team instead of an individual researcher (Cobb et al., 2003; Plomp, 2013; Reeves et al., 2005). As the African proverb goes: “If you want to go fast, go alone, but if you want to go far, go together”. Student success and the pursuit of equity in the South African context is to “go far”. The research team often consists of a variety of participants from the different stakeholder groups and levels, giving everyone a voice in finding a solution as well as critiquing the proposed solutions. In the instance of this study, the PhD student was the lead researcher and met with the assistant researcher on a weekly basis. Meetings with the tutors and mentors, as part of the support team, took place after all 12 intervention activities with each cohort. These and all contact sessions with and feedback provided by the students were documented.

c. DBR is implemented in phases

To provide the research team with structure, the processes and procedures of DBR typically consist of three phases (Bakker & Van Eerde, 2015; Mor, 2010; Plomp, 2013), which are applied sequentially. However, Mor (2010, p. 48) warns that: “In reality, the boundaries between the three phases are often blurred”, informing a character of overlap and mutual complement. The research reported on here happened over three consecutive years and involved three phases per cohort. Each year’s phase evolved as new suggestions for improvements were collected from the participants and research team, often overlapping with feedback from students who were both participants in the previous cohort and then mentors in the next. Overlapping also occurred due to the many activities per intervention where feedback on specific sections (like lecturing style) was repeated.

Preliminary Research Phase. The preliminary phase is sometimes called the analysis and exploration phase (McKenney & Reeves, 2012), or the framing phase (Fransman, 2014; Mor, 2010). It includes a comprehensive investigation into the identified problem

(McKenney & Reeves, 2012; Van den Akker, 2010), which Nieveen and Folmer (2013, p. 154) call “the gap between the current and desired situation”. It starts with a thorough literature review (Herrington et al., 2007; McKenney & Reeves, 2012; Nieveen & Folmer, 2013; Plomp, 2013; Reeves et al., 2005) using previous research outcomes, observations, interviews, discussions, etc., to inform the problem statement. In fact, almost any methodology can be incorporated into this design process, as the researchers need a rich understanding of the problem from various perspectives. This multi-method approach is encouraged during all the phases since solutions are often made up of a combination of ideas and interventions. Therefore, DBR is often associated with *mixed methods* research and *pragmatism* as research paradigm.

The preliminary phase concludes with the design of a tentative solution (intervention), as a first attempt to solve the research problem. It is mainly based on the researchers’ knowledge and the literature review. The first prototype provides the framework for further data collection and discussions that will follow in the next phases. In the study reported on here, the researcher had a developed intervention in place for over eight years. The developed intervention was based on educational psychology and extended programme involvement. The first prototype version was tightened through a literature review and peer-review process involving facilitators from other universities and other support programmes. The initial prototype consisted of 14 themes with accompanying activities.

Prototyping Phase. The prototyping phase consists of several iterations or cycles of implementation and thus are *phases within a phase*. As the first cycle within the prototyping phase, Prototype 1 is implemented. Nieveen and Folmer (2013, pp. 156–157) define the term *prototype* as “a tentative version of the whole (or part of an) intervention before full commitment is made to implement it”. As part of the refining process, the prototyping phase continues with consecutive, improved versions of the intervention until the final version with its activities is arrived at. Van den Akker, (2010) calls this the design experiment phase with its repeated process of consecutive estimates.

To refine the content and enhance the quality of the prototype, continuous participant and researcher feedback, and reflections by the research team are fundamental ingredients of the prototyping phase. The feedback is gathered via a variety of possible means and is provided as *formative evaluations*. Any productive method can be utilized to get feedback, with surveys, questionnaires, interviews and observations being the most common. Van den Akker (2013) emphasises that the function of formative evaluation feedback is “more” than simply detecting limitations of the evaluated prototype, in that it accentuates the importance of detailed recommendations for improvement. The development described here for example, went through two prototyping cycles with feedback and input from the participants and the research team. In the third cycle, significantly fewer changes were recommended for implementation, indicating that the final prototype was crystallising.

The prototyping phase proceeds through an iterative progression with continuous cycles of design, evaluation and revision, as seen in Figure 1.

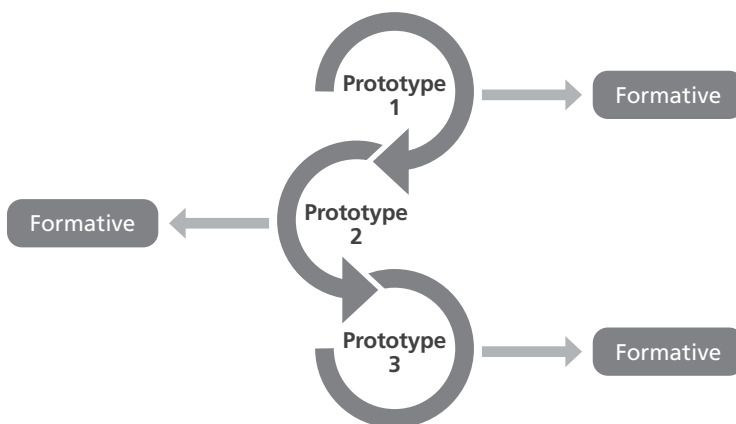


Figure 1: Prototypes informed by formative evaluations (Karsten, 2018, p. 88)

Nieveen and Folmer (2013, p. 157) call this process *evolutionary* prototyping. The final version is presented as a single, comprehensive intervention (proposed prototype) and is recommended for full implementation. Another function of formative evaluations is to inform the development of the design principles, as a secondary outcome of all DBR endeavours.

Karsten (2018), however, showed that the iterative process, informed by the process of continuous evaluation, reflection and feedback, actually consisted of adjusting not only the whole design from one prototype to the next, but also adjusting individual activities within and across prototypes. For example, feedback on *lecturing style* in Prototype 1, Activity 1, could already be adapted for Activity 2 in Prototype 1 and was not only relevant for the same activity in Prototype 2. An illustration of this design process is given in Figure 2.

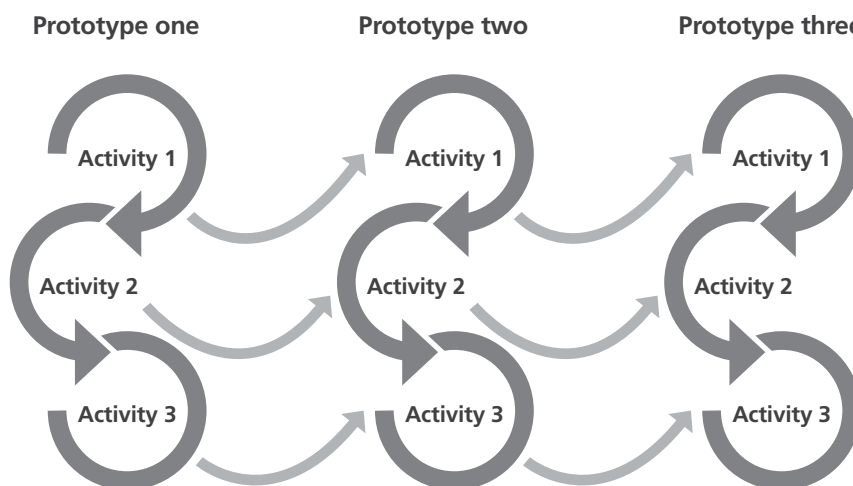


Figure 2: Design adaptation process (Karsten, 2018, p. 92)

Evaluation and reflection phase. As a final assessment of the complete DBR process, the evaluation and reflection phase is implemented. According to DBR guidelines (Nieveen & Folmer, 2013; Plomp, 2013), this phase is used to summatively evaluate the recommended solution (the proposed final prototype) in appropriate ways. Crucially, this includes the participants' ability and willingness to implement learnings from the experienced prototype, within and to their contexts.

Figure 3 shows a framework as guideline for the possible implementation of the DBR phases with accompanying processes and procedures (adapted from the framework applied in the PhD study reported on in this article).

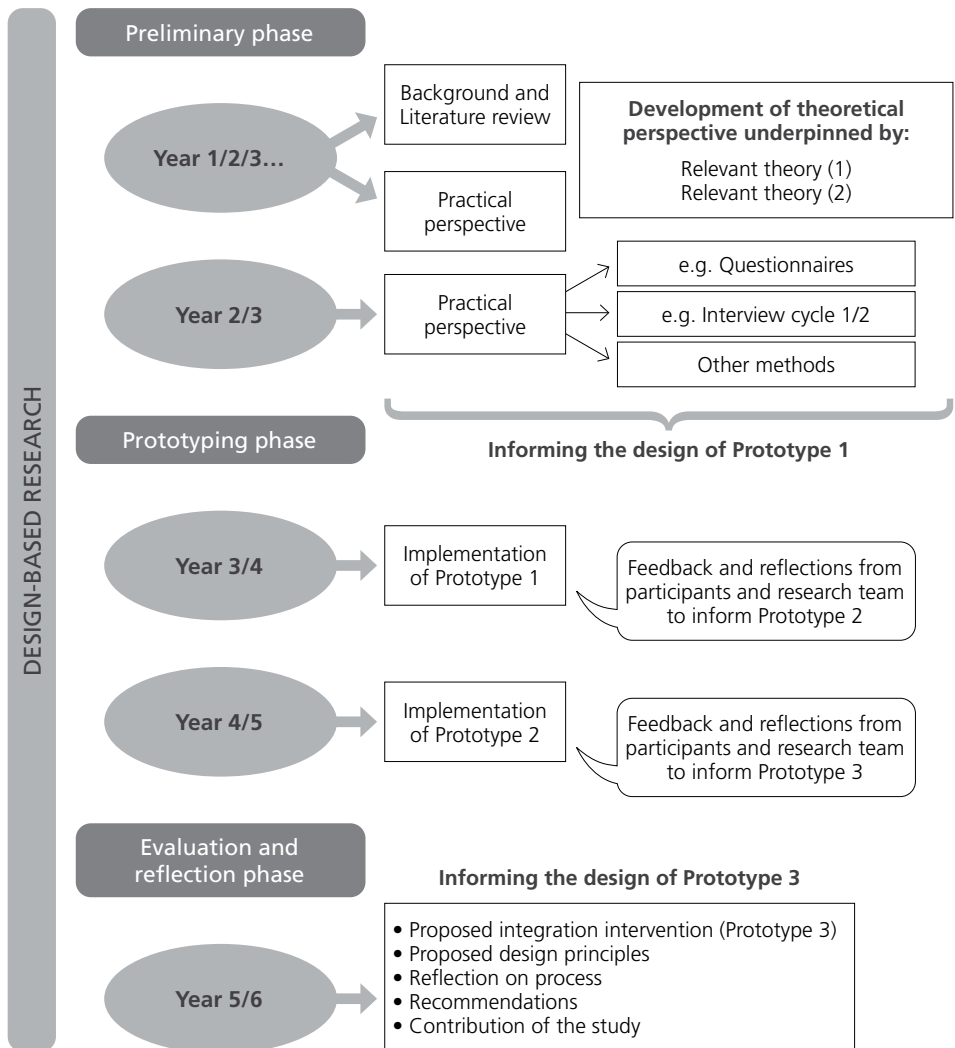


Figure 3: A proposed framework for the implementation of the DBR phases (Adapted from Karsten, 2018, p. 170)

Nieveen and Folmer (2013) indicate that the evaluation of the final prototype should investigate both its practicality and its effectiveness. They recommend that these two attributes should be evaluated by comparing the expected and actual outcomes.

The *expected* practicality and effectiveness of an intervention are evaluated against what is recorded in existing literature, as well as through the data and their analyses as part of the DBR process. In measuring *effectiveness*, McKenney and Reeves (2012, pp. 142, 170) recommend that researchers ask the question: “How effectively does the intervention solve the problem?” They suggest two types of evidence when assessing *practicality*, namely (1) *Perceived evidence of practicality*, which assesses the design of the intervention, and (2) *Objective evidence of practicality*, which assesses the constructed prototypes (McKenney & Reeves, 2012, p. 178). McKenney and Reeves (2012) warn that a practical feel and ease of implementation do not automatically imply increased effectiveness or sustainability. During the DBR process it should be recognized that such an evaluation is open to subjective interpretation.

If both the expected *effectiveness* and *practicality* of the proposed intervention are found to be viable, a decision should be made regarding possible further implementation of the prototype. The concluding prototype is also called the final deliverable (Nieveen & Folmer, 2013) and is put forward as the proposed solution to the research problem. Evident in the evaluation of the final version of the intervention developed, were a saturation of suggestions from the participants and research team, approval from the support staff from other universities, and an indication that student academic results improved.

d. DBR follows an iterative process

One of the main strengths of DBR is that it allows the researchers to practically and patiently “test drive” the possible solution (Prototype 1), making adjustments according to valid feedback, and “test drive” it again (Prototype 2), and again (Prototype 3), until a level of saturation and satisfaction is reached. These repetitive design cycles (Cobb et al., 2003; McKenney & Reeves, 2012; Nieveen, 1999; Plomp, 2013; Van den Akker, 1999) ensure that the final iteration is context-sensitive and comprehensive, with all stakeholders having provided their inputs. The final iteration in this study points to an intervention tailored to students in a South African university, entering HE from a low socio-economic background, displaying high academic potential towards a career in accounting.

e. DBR has a set of dual outcomes

The phases as proposed by Plomp (2013) formed the basis of the methodology, with the dual outcome of a contextualised “final” or proposed prototype, as well as a list of design principles representing guidelines for the implementation of support interventions in similar contexts. A summary of the final proposed version follows.

Table 1: A summary of the final intervention

Step 1: Selection of and communication to participants (Time frame: October to January)	
Institutional action	Key factors and focus points
Selection Admission Communication	<p><i>Adhere to the criteria of:</i></p> <ul style="list-style-type: none"> – Institution – Bursary funders – HE policies <p><i>Suggested measures:</i></p> <ul style="list-style-type: none"> – Students to motivate for their choice of career
<p>Integration of psychological needs:</p> <p><i>Autonomy</i></p> <ul style="list-style-type: none"> – Observe students' abilities to provide motivation(s) for their career choices. – Observe and assess students' knowledge of the compatibility of their career choice with their own abilities and interests. <p><i>Competence</i></p> <ul style="list-style-type: none"> – Demonstrate competence in personal organisational and communication skills. – Observe students' academic competence (evident in NSC and NBT results). <p><i>Relatedness</i></p> <ul style="list-style-type: none"> – Observe students' communication during the selection process (including their written communication on the application forms, emails, and telephone conversations). – Foster a professional relationship by sharing accurate information timeously. – Foster a trusting relationship with students. 	
Institutional action	Key factors and focus points
Institutional communication To share information about institutional requirements, accommodation, bursaries, orientation, and other administrative matters	<p><i>Intervention manager to:</i></p> <ul style="list-style-type: none"> – be warm and inviting, – be reasonably available to address student queries, – communicate timeously, – share accurate information, – refer to various service providers where needed, and – encourage two-way communication.
<p>Integration of psychological needs:</p> <p><i>Autonomy</i></p> <ul style="list-style-type: none"> – Assess and guide students' decision-making skills regarding careers, finances, accommodation, contracts, and other related matters. <p><i>Competence</i></p> <ul style="list-style-type: none"> – Assess students' responses to intervention manager's questions and communication. – Emphasise competent communication skills (like professional greetings, clear language use, including their contact and reference numbers in their communications). <p><i>Relatedness</i></p> <ul style="list-style-type: none"> – Interacting with prospective participants (via phone calls, emails, messages). – Foster a professional relationship by sharing accurate information timeously. – Foster a trusting relationship with students. 	

Step 2: Orientation of participants through the facilitation of selected intervention activities (Time frame: January when students arrive at the institution; 2-week orientation)	
Institutional action	Intervention content, including key factors and focus points
Welcome students	<p><i>Intervention manager to:</i></p> <ul style="list-style-type: none"> – meet the students and their families, – cooperate with residence management and student leaders to welcome the students, – answer questions of students and family members, and – refer students to institutional services where needed (e.g. health services and financial aid departments). <p><i>Keep in mind:</i></p> <ul style="list-style-type: none"> – General orientation of the residence will commence. – Students arrive with different expectations. – The involvement of other role-players like bursary funders, sport societies, religious organisations, and more.
<p>Integration of psychological needs:</p> <p><i>Autonomy</i></p> <ul style="list-style-type: none"> – Observe and guide students' steps towards their independence (by encouraging autonomous decision-making, identifying strengths, and challenging their thinking about their career decisions and goals). <p><i>Competence</i></p> <ul style="list-style-type: none"> – Encourage students' confidence in their academic and other abilities. – Refer to senior students who have "made it" so far. – Communicate in such a way as to stimulate curiosity in the students. – Encourage students' drive to discover their new environment and its' elements, with the cognisance of making autonomous and responsible decisions. <p><i>Relatedness</i></p> <ul style="list-style-type: none"> – Observe students saying goodbye to their families. – Provide some structure to meeting peers, senior students, mentors/tutors, residence leaders, bursary staff, and the intervention manager. – Creating an atmosphere of acceptance, involvement, belonging, and social connection. 	
Institutional action	Facilitation of activities towards integration:
<p>Orientation</p> <p>FYE programme, academic orientation, residence orientation, environmental orientation, initiation of intervention activities</p> <p>Process of integrating into new cultural habitus</p> <p>Intervention manager to clarify her role as support-provider / psychologist / facilitator</p>	<p>IA* 1: Self-knowledge</p> <p><i>To include:</i></p> <ul style="list-style-type: none"> – Personality profile – Conflict management style – Assertiveness style – Multiple intelligence – Stress management – Personal values <p><i>Facilitation guidelines:</i></p> <ul style="list-style-type: none"> – Intervention manager to share about self to build trust, – allow for small-group discussions to encourage interaction, – and discourage unhealthy comparisons between and among students. <p>IA 2: Personal well-being</p> <p><i>To include:</i></p> <ul style="list-style-type: none"> – Personal health – HIV/Aids – Diet/rest/exercise

	<p><i>Facilitation guidelines:</i></p> <ul style="list-style-type: none"> – Ensure confidentiality and encourage trust within the group; – provide practical suggestions to students; – allow sufficient time for discussions and questions; – consider a guest speaker who is an expert, or living with HIV/Aids; – and make students aware of available health and counselling services within the institution. <p>IA 3: Entrepreneurial activity</p> <p><i>To include:</i></p> <ul style="list-style-type: none"> – Relation building / social activity – Problem solving skills – Organizational skills – Communication skills <p><i>Facilitation guidelines:</i></p> <ul style="list-style-type: none"> – Conduct activity close to the beginning of the academic year to allow for senior student participation; – provide structure to the activity to encourage cooperation and optimal interaction opportunities; – and incorporate content on stress-management.
<p>*IA: Intervention activity</p>	
<p>Integration of psychological needs:</p> <p><i>Autonomy</i></p> <ul style="list-style-type: none"> – Assisting participants in making decisions regarding their personal management. – Create awareness of the <i>self</i> and the role of their perceptions and values in autonomous decision-making. – Guiding students in becoming increasingly aware of their uniqueness to develop a healthy self-image and self-esteem. – Encouraging students to provide motivation(s) for their decisions. – Encouraging students to ask for help when needed. <p><i>Competence</i></p> <ul style="list-style-type: none"> – Guiding students to develop a realistic perspective of their competencies in relation to their strengths and experienced challenges. – Encouraging academic progress (passing). – Providing knowledge and opportunities to students to develop competencies in the various skills related to the facilitated activities. – Assisting students to develop confidence in themselves. – Guiding students to set realistic goals (holistically, thus academic goals, health-related goals, relationship goals, and more). – Allowing students to take responsibility for choices and to face the consequences thereof. – Stimulating the feeling of efficacy and mastery. – Creating a safe space where students can strive towards achievement. – Encouraging internal motivation. <p><i>Relatedness</i></p> <ul style="list-style-type: none"> – Creating a warm atmosphere of belonging, acceptance, care, trust and connectedness. – Creating opportunities and providing structure for social activities where students can connect with peers, senior students, mentors/tutors, academic staff, bursary and other support staff. – Encouraging students to build meaningful relationships with others. – Providing opportunities where students can be actively involved in and experience contributing to others. – Making students aware of the available support structures. 	

DBR’s practical contribution is to provide a well-researched solution to an identified problem. In addition, its scientific contributions are (1) making a theoretical input (relevant to validation studies) and (2) offering *design principles* (relevant to development studies) (Plomp, 2013, pp. 19–23). Like findings in case studies, the outcomes of DBR cannot be generalized directly to other contexts (Plomp, 2013). However, *design principles* as secondary outcomes of DBR offer a situation that provides informed advice that approaches a level of generalizability. Within the context of DBR, McKenney and Reeves (2012, p. 20) define generalizability as “being able to transfer theoretical insights and/or practical interventions to other settings”.

Although the implementation of design principles in a different context “cannot guarantee success”, the principles are **pointers** towards contextualising problems via heuristic statements that “are meant to support designers in their tasks” (Plomp, 2013, p. 24). Plomp (2013, p. 24) differentiates between two types of design principles. First, *substantive design principles*, where the focus is on the features of the *design* itself. Table 2 provides an example of a Substantive design principle from the study on which this article is based.

Table 2: Example of a substantive design principle (Karsten, 2018, p. 292)

Substantive Design Principle 4	Appoint and train senior students as mentors as part of the intervention team
Suggestions relevant to Substantive Principle 4	Select mentors with specific competencies and characteristics: <ul style="list-style-type: none"> – Willing to invest time to support peers – Good interpersonal skills – Good time management skills to cope with additional responsibilities – Trustworthy and reliable (treating participants’ information confidentially)

Second, Plomp (2013, p. 24) describes *procedural design principles* as the features of the design *approach*. These principles therefore include knowledge about the suggested process to be followed with accompanying *design activities* that are most likely to impact the intervention successfully.

Table 3: Example of a procedural design principle (Karsten, 2018, p. 304)

Procedural Principle 1	The process of DBR is time and labour intensive and requires the careful selection of a research team relevant to the intervention
-------------------------------	--

Trustworthiness and codes of ethics

DBR, like all other research, necessitates ethical conduct to ensure the trustworthiness of findings and results. These include measures to ensure *validity* and *reliability* (Creswell, 2012, p. 627; McKenney & Reeves, 2012, p. 101). McKenney and Reeves (2012, p. 205) advocate that credibility “has parallels with internal validity, relating to the “truth” of the findings”.

In DBR it is often possible to report on the process as it unfolds, ensuring rich descriptions from observations and reflections. *Credibility*, in DBR with its “prolonged and persistent engagement” (Mertens, 2010, p. 260) requires commitment from and consistency within the research team, due to the scaffolding nature of the data.

Because researchers engage in extended and communication dense research-relationships with participants, high ethical standards in the process of DBR are essential. Participants need to know that their time and input is valued and respected. This time-consuming nature of DBR also requires patience and flexibility from the researchers and can at times be highly frustrating. Nevertheless, all efforts need to be made to adhere to the principles related to ethical conduct (Lichtman, 2010), including the principles to *do no harm* (Marshall & Rossman, 2011, p. 47), respecting participants’ rights to *privacy and anonymity* (Creswell, 2012, p. 23; Grove et al., 2012), adhering to *confidentiality* (Creswell, 2014, p. 100; Grove et al., 2012), assuring *informed consent* (Creswell, 2012, p. 398; Flick, 2014, p. 50), managing any possible *intrusiveness* (Creswell, 2014, p. 94), and *inappropriate behaviour* (Lichtman, 2010, p. 54-58; Marshall & Rossman, 2011, p. 112). The way that data are interpreted and presented should also be done honestly and with all intent to avoid deception (Creswell, 2014, p. 94; Flick, 2014, p. 50). The study in this paper adhered to the ethical guidelines of the institution’s research policy by keeping all data confidential. Student feedback was coded before it was discussed among members of the research team and all personal identifying information was securely stored.

Contribution of DBR

DBR processes and procedures are typically known for their contributions on practical, methodological, theoretical and personal levels. The *practical* contribution is that of the “solution”, also called the intervention, relevant to the context of the study. In this instance it resulted in a final version of the integration intervention that is now being profitably implemented at the university under investigation.

Methodologically, DBR offers a sound and comprehensive vehicle for research reporting of the problem and its background (in the prototyping phase), as well as a well-tested solution to that problem (in the prototyping phase) that has been evaluated as viable and implementable (in the evaluation and reflection phase). This intentional methodology contributes to a process that is context-sensitive, and one where every relevant stakeholder within that context has a voice (Karsten et al., 2020). The iterative nature of DBR allows for repeated verification of data and leaves an open-ended conclusion to all research, since continued and continuous development, growth and change are actual ingredients of the DBR process.

The design principles, as secondary outcomes of DBR, can contribute on *theoretical* levels within a study’s context and field, and enhance the conceptual theoretical frameworks thereof, potentially affecting practices and policies. In this instance, the DBR process resulted in an amalgamation of two theoretical frameworks, namely the *theory of self-determination* (Ryan & Deci, 2002, 2008, 2017) and Tinto’s *theory on integration* (Tinto,

2003, 2014). Lastly, a researcher is unlikely to walk away from a DBR project without experiencing personal development and learning. In fact, in our experience, most members of the research team reported personal value and growth from the research process. After the reported PhD study, one member of the research team registered for her own PhD and several others assumed student leadership and tutorial roles to further increase their impact.

Possible limitations of DBR

There is no doubt that DBR is a lengthy process, but this is both a limitation and a strength. It is a limitation due to its time-consuming nature, and progress often feels slow. Also, with time, participants can either “drop out” of the research or decline further involvement. However, this lengthy process allows for systematic and thorough data, ensuring high levels of trustworthiness. Researcher bias can be another limitation, where the researcher is often deeply involved in the lives of the participants. The use of a research team can bring balance to this limitation, where individual interpretations and observations can be tested against the members of the team.

Conclusion

The importance of strong methodological approaches that are data-informed and comprehensive is continually increasing. Equity and other developmental initiatives are needed to close the gap between what HE support providers think students need, and what students actually need. DBR provides a robust and comprehensive framework for researchers and practitioners to create interventions and programmes that feature high levels of “deliberation, participation, and transparency of decision making” as proposed by Waage et al. (2015, p. e252). In so doing, they create a “safe and just space for humanity” (Hajer et al., 2015, p. 1654). DBR clearly provides one of the few effective vehicles that enable pursuit of effective, context-sensitive and data-informed equity-enabling initiatives. The researchers confidently recommend DBR as a development methodology to those who are seriously pursuing a rigorous and academically sound approach to developing practically implementable interventions. Future research could include aspects such as the intersection between institutional culture and DBR as a viable methodology and the intersection of DBR and the appreciative inquiry model.

References

- Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, 41, 16-25.
- Armstrong, M., Dopp, C., & Welsh, J. (2020). Design-based research. In R. Kimmons & S. Caskurlu (Eds.), *The students' guide to learning design and research*. EdTech Books. https://edtechbooks.org/studentguide/design-based_research
- Bakker, A., & van Eerde, D. (2015). An introduction to design-based research with an example from statistics education. In A. Bikener-Ahsbahs, C. Knipping & N.C. Presmeg (Eds.), *Approaches to qualitative research in mathematics education: Examples of methodology and methods* (pp. 429-466). Springer.

- Barab, S., & Squire, K. (2004). Design-based research: Putting a stake in the ground. *The Journal of the Learning Sciences*, 13(1), 1-14.
- Coates, H., & Radloff, A. (2017). Leveraging student engagement evidence for institutional change and improvement. In F. Strydom, G. Kuh & S. Loots (Eds.), *Engaging students: Using evidence to promote student success* (pp. 123-145). SUN Press.
- Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher*, 32(1), 9-13.
- Cochrane, T., Cook, S., Aiello, S., Christie, D., Sinfield, D., Steagall, M., & Aguayo, C. (2017) A DBR framework for designing mobile virtual reality learning environments. *Australasian Journal of Educational Technology*, 33(6), 54-68.
- Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Pearson Education.
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE.
- Crisp, G., Palmer, E., Turnbull, D., Nettelbeck, T., Ward, L., LeCouteur, A., Sarris, A., Strelan, P., & Schneider, L. (2009). First year student expectations: Results from a university-wide student survey. *Journal of University Teaching and Learning Practice*, 6(1/3), 13-26.
- Department of Higher Education and Training (DHET). (2013). *White paper for post-school education and training: Building an expanded, effective and integrated post-school system*. <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>
- Department of Higher Education and Training (DHET). (2020). 2000–2017 *first time entering undergraduate cohort studies for public higher education institutions*. http://utlo.ukzn.ac.za/Libraries/Documents/2000_TO_2017_FIRST_TIME_ENTERING_UNDERGRADUATE_COHORT_STUDIES_FOR_PUBLIC_HEIs.sflb.ashx
- Fennie, T., Mayman, Y., van Louw, C., Useh, E., & Kombora, M. (2020). Psychosocial factors impacting the college adjustment of undergraduate students: A scoping review. *Journal of Psychology in Africa*, 30(2), 96-105.
- Flick, U. (2007). *Designing qualitative research*. SAGE.
- Flick, U. (2014). *An introduction to qualitative research*. SAGE.
- Ford, C., McNally, D., & Ford, K. (2017). Using design-based research in higher education innovation. *Online Learning*, 21(3), 50-67. <http://dx.doi.org/10.24059/olj.v21i3.1232>
- Fransman, J. S. (2014). *Mathematics teacher's metacognitive skills and mathematical language in the teaching-learning of trigonometric functions in township schools* [Unpublished PhD thesis]. North-West University.
- Grove, S. K., Burns, N., & Gray, J. (2012). *The practice of nursing research: Appraisal, synthesis, and generation of evidence*. Elsevier Health Sciences.
- Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., de Boer, Y., Rockström, J., Ludwig, K., & Kok, M. (2015). Beyond cockpit-ism: Four insights to enhance the transformative potential of the sustainable development goals. *Sustainability* 7, ISSN 2071-1050.
- Hege, I., Kononowicz, A. A., & Adler, M. (2017) A clinical reasoning tool for virtual patients: Design-based research study. *JMIR Medical Education*, 3(2): DOI: 10.2196/mededu.8100

- Herrington, J., McKenney, S., Reeves, T., & Oliver, R. (2007). Design-based research and doctoral students: Guidelines for preparing a dissertation proposal. In C. Montgomerie & J. Seale (Eds.), *Proceedings of world conference on educational multimedia, hypermedia and telecommunications 2007* (pp. 4089-4097). AACE.
- Ilie, S., & Rose, P. (2016). Is equal access to higher education in South Asia and sub-Saharan Africa achievable by 2030? *Higher Education*, 72, 435-455 <https://doi.org/10.1007/s10734-016-0039-3>
- Karsten, I. (2018). *A self-determination intervention to support integration into higher education using a design-based approach* [Unpublished PhD thesis]. University of Johannesburg.
- Karsten, I., Van der Merwe, M., & Steenekamp, K. (2020). Empowering accounting students to enhance the self-determination skills demanded by the fourth industrial revolution. *South African Journal of Higher Education*, 34(2), 36-58. eISSN 1753-5913
- Kroll, C., Warchold, A., & Pradhan, P. (2019). Sustainable development goals (SDG): Are we successful in turning trade-offs into synergies? *Palgrave Communications*, 5. <https://doi.org/10.1057/s41599-019-0335-5>
- Lichtman, M. (2010). *Qualitative research in education: A user's guide* (2nd ed.). SAGE.
- Maluleke, R. (2018). Education series volume VI: Education and labour market outcomes in South Africa, 2018. *Statistics South Africa*. <http://www.statssa.gov.za/?p=13024>
- Marshall, C., & Rossman, G. B. (2011). *Designing qualitative research* (5th ed.). SAGE.
- McKenney, S., & Reeves, T. (2012). *Conducting educational design research*. Routledge.
- Mertens, D. M. (2010). *Research and evaluation in education and psychology* (3rd ed.). SAGE.
- Meyers, G. L., Jacobsen, M., & Henderson, E. (2018). Design-based research: Introducing an innovative research methodology to infection prevention and control. *Canadian Journal of Infection Control*, 33(3), 158-164.
- Mor, Y. (2010). *A design approach to research in technology enhanced mathematics education* [Unpublished PhD thesis]. University of London.
- Nieveen, N. (1999). Prototyping to reach product quality. In J. van den Akker (Ed.), *Design approaches and tools in education and training* (pp. 125-131). Springer.
- Nieveen, N., & Folmer, E. (2013). Formative evaluation in educational design research. In T. Plomp & N. Nieveen (Eds.), *Educational design research. Part A: An introduction* (pp. 152-169). SLO Netherlands Institute for Curriculum Development.
- Plomp, T. (2007). Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds.), *An introduction to educational design research. Proceedings of the seminar conducted at East China Normal University* (pp. 9-35). SLO Netherlands Institute for Curriculum Development.
- Plomp, T. (2013). Educational design research: An introduction. In T. Plomp & N. Nieveen (Eds.), *Educational design research. Part A: An introduction* (pp. 10-51). SLO Netherlands Institute for Curriculum Development.
- Reeves, T. C., Herrington, J., & Oliver, R. (2005). Design research: A socially responsible approach to instructional technology research in higher education. *Journal of Computing in Higher Education*, 16(2), 96-115.
- Ryan, R. M., & Deci, E. L. (2002). *Handbook of self-determination research*. University of Rochester Press.
- Ryan, R. M., & Deci, E. L. (2008). A self-determination theory approach to psychotherapy: The motivational basis for effective change. *Canadian Psychology*, 49(3), 186-193.
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory. Basic psychological needs in motivation, development, and wellness*. Guildford Press.

- Scott, E. E., Wenderoth, M. P., & Doherty, J. H. (2020). Design-based research: A methodology to extend and enrich biology education research. *CBE – Life Science Education*, 19(3). <https://doi.org/10.1187/cbe.19-11-0245>
- StatsSA (Statistics South Africa). (2019). *Inequality trends in South Africa: A multidimensional diagnostic of inequality*. Statistics South Africa Report No. 03-10-19. <http://www.statssa.gov.za/publications/Report03-10-19/Report-03-10-192017.pdf>
- StatsSA. (2020). *Quarterly labour force survey (QLFS) – Q4:2019*. <http://www.statssa.gov.za/?p=12948>
- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). University of Chicago Press.
- Tinto, V. (2003). Student success and the building of involving education communities. *Higher education monograph series*, Syracuse University, 2.
- Tinto, V. (2014). Tinto's South Africa lectures. *Journal of Student Affairs in Africa*, 2(2), 5-28.
- USAf (Universities South Africa). (2018a). *Understanding students: A key to systemic success*. Issue 1, USAf publication.
- USAf. (2018b). *Understanding students: Putting students at the centre of institutional design*. Issue 2, USAf publication.
- Van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, R.M. Branch, K. Gustafson, N. Nieveen & T. Plomp (Eds.), *Design approaches and tools in education and training* (pp. 1-14). Kluwer.
- Van den Akker, J. (2010). Building bridges: How research may improve curriculum policies and classroom practices. In S. M. Stoney (Ed.), *Beyond Lisbon 2010: Perspectives from research and development for education policy in Europe* (pp. 177-195). CIDREE Yearbook 2010.
- Van den Akker, J. (2013). Curricular development research as a specimen of educational design research. In T. Plomp, & N. Nieveen (Eds.), *Educational design research. Part A: An introduction* (pp. 52-71). SLO Netherlands Institute for Curriculum Development.
- Van den Akker, J., Gravemeijer, K., McKenney, S., & Nieveen, N. (Eds.). (2006). *Educational design research*. Routledge.
- Van Zyl, A. (2016) The contours of inequality: The links between socio-economic status of students and other variables at the University of Johannesburg. *Journal of Student Affairs in Africa*, 4(1), 1-16.
- Waage, J., Yap, J., Bell, S., Levy, C., Mace, G., Pegram, T., Unterhalter, E., Dasandi, N., Hudson, D., Kock, R., Mayhew, S., Marx, C., & Poole, N. (2015). *Governing the UN sustainable development goals: Interactions, infrastructures, and institutions*. Lancet.
- Wolcott, M. D., Lobczowski, N. G., Lyons, K., & McLaughlin, J. E. (2019). Design-based research: Connecting theory and practice in pharmacy educational intervention research. *Currents in Pharmacy Teaching and Learning*, 11(3), 309-318. <https://doi.org/10.1016/j.cptl.2018.12.002>

How to cite:

Karsten, I., & Van Zyl, A. (2022). Design-Based Research (DBR) as an effective tool to create context-sensitive and data-informed student success initiatives. *Journal of Student Affairs in Africa*, 10(1), 15-31. DOI: 10.24085/jsaa.v10i1.3706