

Design-Based Research in Education: A Prolific Approach to Applied Research in Developing Countries

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While not underestimating the role of more conventional approaches in the field of educational research, this paper discusses Design-Based Research or DBR as a useful paradigm and a prolific approach to applied research in the area of distributed leadership in the context of developing countries like Pakistan. Some details of this approach in the light of a literature review and the findings of a DBR study conducted in a low-fee private elementary school in Pakistan are presented to advocate and promote its usage by educational researchers in developing countries. Arguments are presented in favour of DBR as a valuable research framework for improving the educational practices by addressing issues and problems at the ground level. It is important that we make research more useful for the real world educational settings and culture of developing countries and try to put theory into practice by developing suitable context-specific designs of educational practice, systems and products. There is a great scope for DBR to be as generative as other established modes of educational inquiry.

Key Words: *DBR, school education, developing countries, instructional practice, distributed leadership,*

Introduction

While exploring new avenues in educational research it is also important to analyze the applicability of this research in a wider context. Many researchers in developing countries, like Pakistan, try to adopt new theories emerging in the west but often similar gains are not achieved and so there is a tendency to discard new developments by simply saying that our system is too different for the concepts to work. While there may be some truth to this conviction, many factors need to be considered. Incredible are the scholars who create new ideas and fine-tune and polish them in particular contexts until they gain popularity

as valid theories of practice. A similar kind of ability is required to translate the new notions and ideas into meaningful, applicable and practical concepts in other settings. Designing with originality is genius and copying is a mere act of imitation. Genius is again required to adjust a theory to another situation and fine-tune and polish it for applicability in that new context. DBR can allow such genius to develop.

What is DBR-- Design-based research or DBR is a relatively new research approach and has been called a methodological paradigm for studying and specifying how to conduct design studies or educational interactions and interventions (Dede, 2005).

Wang and Hannafin (2005) define DBR as a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development and implementation, based on collaboration among researchers and practitioners in real-world settings, leading to contextually-sensitive design principles and theories. DBR has other names; design experiments, developmental research and interventionist ethnography. As 'interventionist ethnography' it aims to study educational interventions in real-world natural settings through ethnography.

The design may be for an educational task such as a teaching methodology, a new educational technology, creation of a system of practice such as leadership practice or even for studying already established practices and improvement initiatives. What gets designed is a whole system with its various components like a design of the associated learning environment, the tasks, materials or tools essential for practice and all other design requirements according to the needs of the situation. The aim of a DBR researcher is to empirically extract a set of richly described guidelines or design principles for an intervention in education which can be used by others interested in

similar concerns in similar settings (Amiel & Reeves, 2008). Theory development and testing can also occur simultaneously (Markauskaite, Freebody & Irwin, 2011) though after multiple design investigations. DBR integrates a variety of research methods within its phases (Ross & Morrison, 1996), but it is not merely a design using multi-methodology. According to Ann Brown (1992, as cited by Barab.S. 2004), DBR was introduced with the expectation that researchers would systemically adjust aspects of the designed context so that each adjustment served as a type of experimentation allowing researchers to test and generate theory in naturalistic contexts.

Why use DBR-- Reform initiatives can be more successful if DBR is used to assist the implementation process and the specific context of the schools is included in the design of the intervention itself. This is because to achieve positive outcomes, it is crucial to satisfy the apprehensions, anxieties, inadequacies and belief systems of the local practitioners and support them in the various adaptations of the program in question through its fine-tuning in small progressive and coherent steps (Penuel, Fishman, Cheng & Sabelli, 2011). Concepts and theories developed in western or other

contexts can easily be tested against the very different backdrop of developing countries and useful adjustments can be made to gain more benefit from the work of educational scholars elsewhere. New theories adjusted to the needs of the local practitioners can also emerge through this process. DBR satisfies the need for bringing together the researchers, practitioners and policy makers to work in collaboration. The credibility of research evidence produced is enhanced by incorporating real-life ground realities of educational situations and aligning theories with workplace practice.

DBR and Controlled Experimental Designs-- For testing the applicability of an intervention on relevant outcomes exploration of the phenomena or concepts under consideration is essential, but doing so in controlled experimental conditions ignores real-life situations. Such studies, though effective in studying the relationship between specific variables, do not incorporate the complexity of real life where many variables, crucial to the success of an intervention, interact. If an experimental design were used for the study quoted here it would not have been possible to obtain important insights into the complexity of the practical aspects of leadership and instruction in a unique real-life educational

setting. DBR allowed incorporation of this complexity into a workable design for distributed leadership.

Central to the idea of DBR is the design. The word 'design' is taken as a verb and a noun. The verb refers to the activity of designing and is a creative process of generating and testing hypothetical solutions to problems while design as a noun is the solution that is generated. As a result of design as an activity, a form of the design as a solution is created to direct and guide particular behaviours which are then compared to the intended functions of the design. Design-based researchers often elect to work across the paradigms if it will benefit the educational outcomes and the theory at hand (Bell, 2004). There can be many approaches to DBR based on the epistemological concerns of the researcher. This study employs the cultural anthropology perspective (Bell, 2004) which emphasizes the localized nature of leadership practices and norms of the leaders and teachers within their specific school setting. Bell (2012) has quoted Brown (1992) and Collins (1992) as being the pioneers of DBR in the field of education. The unique qualities of the designs make them special and provide greater reliability of the data collected giving greater

credibility to the educational approaches addressed by the designs. Some unique features of DBR in education are presented here:

1. DBR is iterative, interventionist and theory-oriented (Cobb, Confrey, diSessa, Lehrer and Schauble, 2003). Instead of simply testing theories or developing and testing an intervention in controlled conditions DBR tries to discover ways to build systems based on theories and determine the effectiveness of these systems in practice (Walker, 2006, as cited by Abdallah & Wegerif. 2014).
2. The objective of the design is to improve practice by generating theory and stimulating thought experiments. The theories produced may address design frameworks, design methodologies or theories of knowledge and practice (Dede, 2005).
3. DBR fills the gap between basic and applied research in education. (Brown, 1992; Reeves, Mckenney and Herrington, 2011). Interventions take place in reality contexts incorporating the concerns and constraints of real-life situations and their solutions which have been tried, tested and fine-tuned in repetitive cycles. During the process there is a better understanding of the characteristics of the interventions, the design processes involved and their evolution over time (Plomp & Nieveen, 2007).
4. The design may have a material form such as a blueprint or a physical model or it may be a new system or process for achieving a goal. It may also be the design of an intervention which undergoes extensive fine-tuning from inception to final product (Middleton, Gorard, Taylor & Bannan-Ritland, 2008. as cited by Dai, 2012).
5. The design must be logical and yet flexible enough to incorporate the unique circumstances of the school (Bell, 2012). An intervention successful in one local context can be transferred to other similar or dissimilar contexts due to adaptability (Dede, 2005).
6. The design must incorporate design processes such as social interactions and collaborations amongst researchers and practitioners to promote contextual relevance and increases participant commitment to the improved practice (Bell, 2012).
7. It must incorporate systematic processes of documentation, analysis, reflections, revisions and evaluations of the design

(Collins, Joseph, & Bielaczyc, 2004; Bell, 2012)

8. DBR incorporates multi-methodology for collecting data (Stemberger & Cencic, 2014) and occurs in longer time scales which provide a systematic and scientific rigour to the design in its attempt to change practice (Bell, 2004).
9. DBR outcomes are a set of design principles, a new theory, or a revised practice (Bell, 2012). Practitioners are involved as designers of their learning environment.

Limitations of DBR-- Bell (2012) reports three factors putting limitations on DBR.

The role of the researcher. The researcher in case of DBR is the designer of the intervention, the implementer and also the evaluator and this introduces researcher bias to the study. This limitation is removed by using multi-methodology which ensures the triangulation of data and findings (Stemberger & Cencic, 2014).

The problem of multi-methodology. Critics doubt the feasibility of multimethodology. Proponents maintain that all methods are intricately linked to the research goals and are therefore relevant, and provide triangulation and convergence of strategic points in the research (Bazeley, 2004; Smith, 2006 as cited by Bell, 2012).

Generalizability and reliability. The research design keeps changing which, for critics, is a sign of lack of consistency and a threat to reliability. The changing nature of the design is evident during iterations where each cycle takes into account the findings of the previous cycle. Proponents insist that the design does not change but rather develops through the iterative cycles and the changes are the result of 'evolutionary planning'. Not everything in the initial design changes at any point as only crucial findings cause rethinking of certain elements; after careful reflections to obtain an optimum design, changes are made only in these relevant areas. For proponents, multi-methodology takes care of any issues of reliability (Bezeley, 2004; Mckenney et al, 2006 as cited by Bell, 2012). It is also argued that the aim of DBR is to address the concerns of a specific context and not to worry about generalizability. Wang and Hannafin (2005) assert that the theory underlying the design and its proper incorporation into the design is important. The goals of the design must be the same as the theoretical goals of the design and supported by the knowledge base of the discipline being targeted. This retains the necessary link between a specific DBR study and other studies in the same area,

enhancing the generalizability of the theory itself in different contexts.

For some researchers, DBR does address the issue of generalizability by incorporating formative and summative strategies. While formative strategies describe the immediate research context, summative strategies make the findings generalizable to other settings as more general conclusions can be drawn on the basis of the findings (Collins, Joseph & Bielaczyc. 2004).

DBR in Practice: A Case Study

School Education in Pakistan.

School education in Pakistan is not uniform and policies prepared by the government, while unsupported by authentic research, hold a statutory status only for public education. The private schools are free to follow their own curricula and make their own policies; the few regulations that exist are hardly enforced in practice (Govt. of Punjab, 2013). Schools range from elitist private schools in line with world standards to public schools struggling to keep up with the standards enforced through public educational policies; but there are also the completely independent, un-supervised and un-regulated private institutions including the huge number of low-fee private schools. Research in Pakistan must take into account

all types of schools and their specific contexts. DBR can make research context-specific.

Problems and issues in developing countries like Pakistan are mostly related to access to and basic facilities for education, quality of teaching and learning and professional development. The UN Global Education Report, 2016, puts Pakistan 50 and 60 years behind in achieving the targets of primary and secondary education respectively (Reuters, The Express Tribune, 2016). The curriculum, teachers and school environment, described as the pillars for cultivating and maintaining quality in education, suffer from inadequacies and inefficiencies in public and private schools. Teaching the textbook is the norm as assessments are based on textbooks. The school environment is deficient in terms of infrastructure, basic facilities and socio-cultural aspects (Aly, 2007).

Often the quality of teachers is a major issue. There are factors like apathy, poor motivation, lack of initiative, lack of autonomy, incompetence etc. due to which real change is not seen in the classrooms (Siddiqui, 2010; Goderya-Shaikh et al. 2006). While public and elite private schools have elaborate professional development systems, most low-fee private schools all

over Pakistan ignore this important area; professional education is not mandatory and the teachers' qualification at times is only a basic ten years matriculation certificate.

Existing Educational Research.

Most educational research in Pakistan is based on the well-established quantitative paradigms but an emphasis on qualitative and multi-methodological studies is also growing. Although there is little doubt about the significance of these approaches, it must be realized that the problems in a developing country are different from those in developed countries. Research must be made useful for the practitioners and relevant to the educational context of particular countries. Researchers in Pakistan need to explore approaches such as DBR to see what innovative solutions to our specific problems can be achieved. A DBR study with a focus on distributed leadership was not found during the literature review.

Background of the Study

An in-depth ethnographic case study was carried out in a low-fee private elementary school in Pakistan. The aim was to explore the nature and quality of distributed leadership (DL) practices for instructional improvement. As the study progressed, it was recognized that the deficiencies in leadership and instructional

practices are pronounced. While looking for DL, a dearth of leadership itself was found and the instructional practices were catastrophically poor in quality. Quality, in this case, was referenced to the National, though non-statutory, Teachers' Professional Standards and the National Curriculum of English, 2006.

It was found that student learning was totally rote-based and devoid of any analytical, critical or creative thinking skills. Instructional practices were limited to teaching the textbook and exams. Teachers lacked professional competence and leadership was limited to maintaining the status quo. No document was available to guide or to evaluate practice and there were no teaching aids except for chalks, duster, blackboard, textbooks and a stick.

Choosing DBR as the research approach. Plomp & Nieveen (2007) contend that design-based research is appropriate in situations where the educational problem at hand is huge, important and complex and clear guidelines on how to address the problem are either not available or are not considered potentially satisfactory in the given situation. The significance of the problem should be such that resolving it will lead to the considerable betterment or at least a considerable reduction in a

malfunction in the educational system. DBR is also appropriate when other measures have failed to produce the desired outcomes and the problem is somewhat 'wicked' which according to Rittel & Webber, 1977 (as cited by Plomp & Nieveen) means that the problem is so complex that obtaining a solution is 'frustrating' or the solution is almost 'potentially unattainable'. All these criteria were being met in the situation at hand. The complexity of the problems demanded a unique and as yet untried solution.

During situation analysis, assigned leadership was found to have the greatest role in determining and influencing school routines and instructional leadership was non-existent. A solution targeting leadership practices seemed the most reasonable; if instructional leadership could be developed and distributed in the school on a large enough scale the practice of instruction could be influenced substantially and student learning would improve accordingly. A model for DL was available in the context of other countries where teacher competence is not a major issue and teaching is a licensed profession. The factors considered important for such models were almost non-existent in the school under investigation. Here was a chance to see if the so hailed

concept of DL could be a remedy for improving the instructional practices in the school but, it was difficult to understand how it would actually work out under the given conditions. A new design of DL was needed but its specifics were not clear. DBR is appropriate in such situations and even when indicators of success are vague or undetermined as the same become evident during the design evolution process. A DBR approach allows building on an initial draft design according to contextual requirements. The aim of conducting DBR was to implement a solution through a DL design and extract some design principles which could provide a better understanding of the phenomenon in the context of Pakistan and assist other researchers in developing practical research-based DL intervention programs for instructional improvement.

DBR and its phases. An initial DL design was drafted and implemented and evolved through many stages, addressing the concerns of teachers and school leaders at the ground level; finally, a design was shaped with potential for achieving the required change systematically.

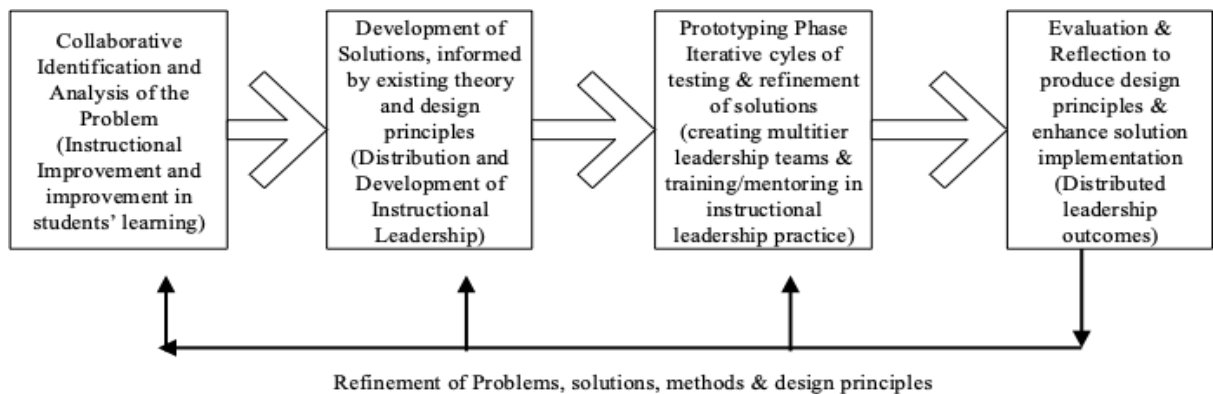
Suggested phases of DBR include the six phases by Easterday, Lewis & Gerber (2014), the four by Reeves (2008) and three by Plomp (2007, as cited by Abdallah. &

Wegerif, 2014); the idea is to understand and analyze the problem and then work out a solution and fine tune it in iterative cycles of practice; the phases do not progress in a linear fashion. The four phases for this study, based on recommendations of researchers, are outlined below (Figure 1).

Phase I. Identification and Analysis of the Problem. This preliminary phase includes developing a focus, understanding and defining the problem. The problem was identified as the dismal situation of instructional practices and resultant students' learning in the subject of English. More specifically the problem was to bring

the instructional practice and students learning more in line with the requirements of the National Standards for Teachers in Pakistan and the national curriculum of the targeted subject.

Phase II. Development of Solutions. Solutions are conceived on the basis of available theory, literature review and the contextual aspects of the situation at hand. The proposed solution in the study was to improve the instructional practice at the school through the distribution of leadership or to design a DL program for instructional improvement and students' learning.



Adapted from Reeves (2006)

Figure 1 Phases of DBR

Phase III. The Prototyping Phase. This involves iterative steps to test and refine the solution in practice. Feedback from participants and results of formative assessments of teachers' instructional practice, students' learning and leadership practices were obtained throughout the study

and supported the designing of iterations and in guiding further improvement and fine-tuning of the design. Iterations were also in the form of sub-components of the basic design. A workable, theory-based and contextually relevant DL system design for instructional improvement was aimed. In

developing systems, it is feasible to let the main approach continue and build on other needed elements in repetitive cycles so that they form an integral part of the design itself. This method suggested by Easterday, Lewis & Gerber, (n.d) was used in this study.

Phase IV. Evaluation & Reflection

Phase. This involves continuous reflection, formative assessments, and summative evaluations of design components to derive design principles which can further improve the solution implementation in the same or other similar contexts and contribute to theory in this area.

DBR in action. The basic goal of the study was to distribute leadership by developing leadership teams and achieving the objective of instructional improvement and students' learning through their activities. An initial draft design (Figure 2) was prepared after a literature review, analysis of DL theory and principles of practice and DL designs implemented elsewhere. Provisions were made for contextual variables and implementation started as the first cycle of the DL design.

Soon it was realized, as a result of reflection, formative assessments and feedback that more changes will be required because of issues like professional

competence, time for interaction and resource availability. Changes were made after consultation and negotiation with the school management and the main design proceeded with revisions along the way. Three tiers of DL were created. By the end of the study, the second tier was the most effective while the first tier of the principal and vice principal was less involved. The third tier of class representatives was slow in progress and mostly remained dependent on the higher leadership teams. They needed more time to develop their knowledge and skills and through arrangements were put in place for a continuous professional development program, only a few teachers showed evidence of emergent leadership. Teachers were given autonomy and a supportive culture but they had little idea how to make use of that autonomy for improving their own practice and the learning of students. The design evolved at its own pace but considerable success was achieved by the end of the study. Figure 3 presents the final design that evolved.

Aspects such as continuous professional development, supervision and monitoring of practice and most importantly the process of developing the tools for leadership and instructional practice required separate design iterations. These

problems were analyzed separately under the four phases of DBR seeking solutions through DL. Responsibility for professional development and the creation of tools for practice was given to teachers and leaders. The two sub-designs passed through their own iterative cycles and the results contributed to the improvement of the main design (Figure 4). As an example, teachers' concepts about education and good practices were vague and incorrect; they knew little about authentic and holistic education, effective classroom management or other educational concepts. Each of these

problems was taken up separately in successive cycles of professional development to improve teacher competence. Similarly, after realizing the need for tools, the same was created by addressing each area of practice; in case of instruction, flashcards, posters, supplementary material, activity sheets, etc. were prepared and for leadership practice, tools such as an educational vision, curriculum of English, teaching and learning targets, tools for supervision and classroom observation etc. were prepared.

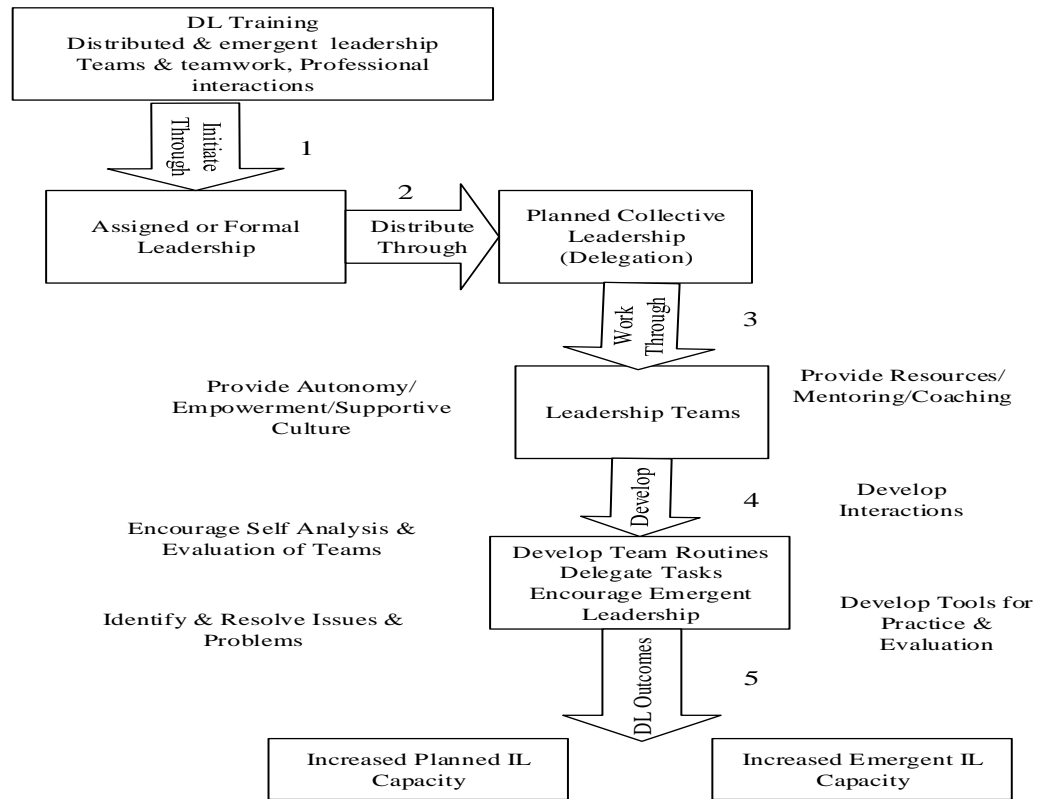


Figure 2. Initial Draft Design of Distributed Leadership

Problems and Issues during the DBR Study

DBR is only a framework and the details need to be worked out by the researcher. This required a lot of reflection, critical analysis and problems solving skills. Support from theory was utilized but

complex contextual factors had to be considered too. It was a rigorous and time-consuming exercise to work out the details for practical implementation and to make changes along the way.

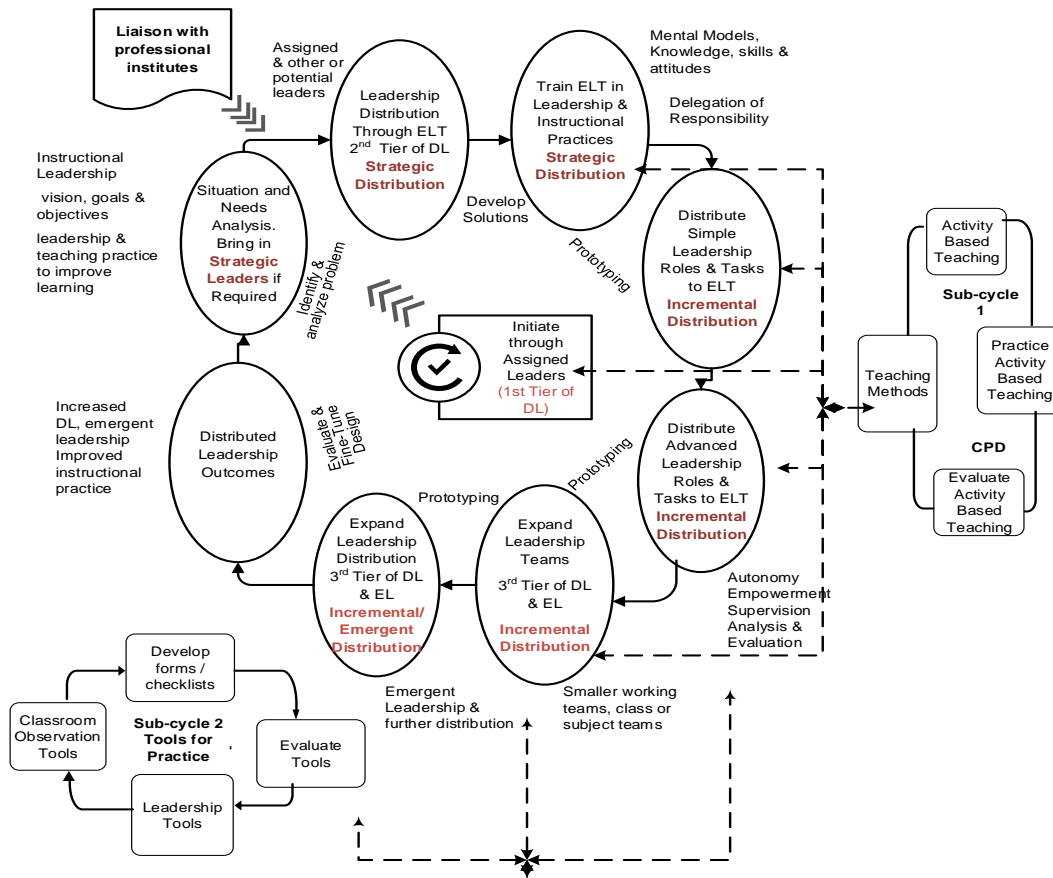


Figure 3. The Final DL Design Derived through DBR

Designing iterations on the basis of assessment, feedback and reflections was a complex and multifaceted task. The iterations were in the form of sub-designs for teachers' professional development and for preparing tools for practice as well as in the form of feedback loops to improve aspects of the main design at specific points; incremental improvements and alterations were made as the design evolved.

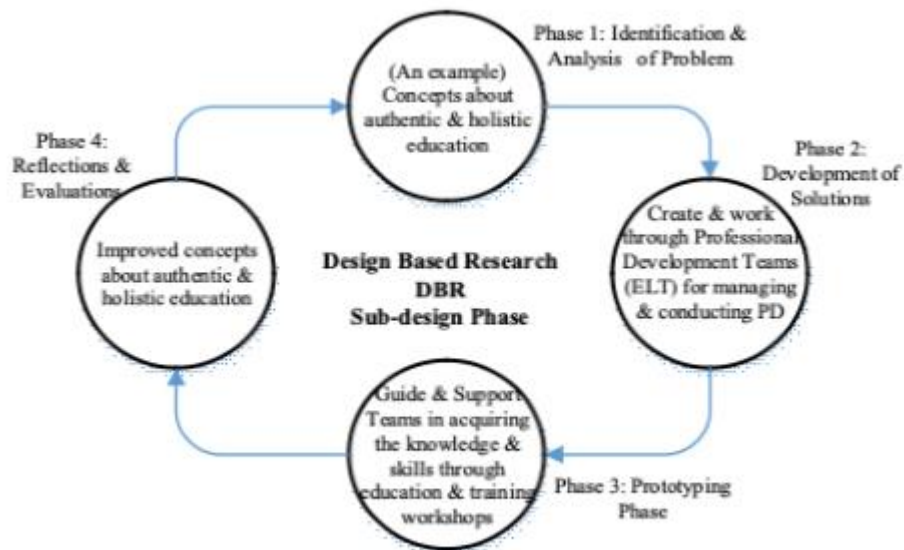


Figure 4. Professional Development Program Sub-design as Part of the Final DL Design

Cooperation of the management is crucial in conducting DBR as the quick fixes that they demand cannot be provided. The role of the principal is crucial but he remained an obstacle and had to be convinced time and again of the purpose and benefits of the study. All others in the management were cooperative especially the vice principal, also the co-owner of the school. DBR takes time as the design evolves in phases the details of which cannot be predetermined. Much depends on the contextual problems and issues understood only during the research process; ground realities became blatantly obvious during the practical phase of design evolution and refinement. Time was also required because of the nature of DL

practices. Researcher bias was handled by documenting everything carefully in detail and reflecting on the data thoroughly to differentiate fact from opinion. All discussion and analyses were supported by evidence from the study. National Professional Standards for Teachers in Pakistan and the national curriculum for English were taken as reference for defining good teaching practices and students' learning competencies. It is a good idea to involve a team of researchers so that maximum aspects of the situation and theoretical knowledge can be handled and incorporated.

The outcomes of DBR. DBR as a research methodology proved to be a good choice. Decisions were taken in a flexible

working environment according to the situation instead of under the strict controls of an experimental approach. It was possible to proceed on the basis of feedback and formative evaluations. Subsets of the main design also evolved. The practical experience of DBR provided a chance to better understand this approach and its significance in the context of Pakistan. It can be used to design systems as well as products and both are needed in our education system. Not all problems and issues were resolved but a predominantly positive response was obtained. There was an increase in DL capacity and quality as more people were engaged in a practice close to instructional leadership. Teachers' instructional practices improved. Follow-up visits to the school revealed that many of the practices were still in place and a larger part of the design was being adhered to through some old practices had returned. The reason for this was analyzed as lack of continuous professional support and the stubbornness of the principal in continuing the old tried and tested practices which earned marks for students and kept the parents satisfied. The principal was not ready to critically analyze his educational beliefs; for him, he was part of a system where education is the way it is and one school cannot take the responsibility

of change. The vice principal, also a co-owner of the school and the DL team created during the study kept the change dynamic and alive. The above situation points to a major issue in the education system of countries like Pakistan. Teachers' and leaders' competence in terms of knowledge, skills and attitudes are the prime factors for influencing the change of any type or magnitude.

Concluding Remarks

In spite of the large volume of educational research it has often been labelled as neither useful nor influential (Burkhardt & Schoenfeld, 2003, as cited by Drill, Miller & Behrstock-Sherratt.2012). Kaestle, (1993) has even called educational research as 'awful'. This state of affairs is especially true for developing countries like Pakistan where little practical gains are achieved from research conducted locally or even that in other countries. One reason is that teachers, school leaders, and even policy makers, do not have access to all the research findings and recommendations and most do not understand the content of research unless it is greatly simplified for them. Most discard educational research as too theoretical and devoid of any contextual relevance to the classroom realities of different types of schools. Those who do

understand educational research in Pakistan must make it available to the practitioners in simplified and contextually relevant ways to make it applicable and practical for all education and school improvement efforts. DBR has much to offer in accomplishing this goal. According to Nawab (2011), the educational context of a country and more specifically of a school plays a crucial role in resolving issues and problems and amendments have to be made in theories and approaches recommended by the developed countries for any sustainable educational improvement. Educational theories or interventions cannot and should not be rejected simply because there are weaknesses in our own educational system; redesigning of the approaches and some crucial adjustments in the context of developing countries must always be considered before discarding any theory as not workable. While we need to develop our own theories and practical solutions to our own problems we can also benefit from research findings all over the world. This is an important research consideration in the context of Pakistan and DBR can be a useful approach towards achieving this end. Though a set of design principles were derived on the basis of this study it is important to conduct studies in other similar

as well as dissimilar contexts to evaluate the effectiveness of the design. It is alright to conclude the research at a point where others can take it up and evaluate its effectiveness or otherwise of the design principles and also refine the design further. DBR researchers simply aim to make their contribution to research according to particular contexts. Many similar contributions can then allow theory building to take place.

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