Designing Questions for Research Design and Design Research in e-Learning

Johannes C. Cronje
Cape Peninsula University of Technology, Cape Town, South Africa
Johannes.cronje@gmail.com
DOI: 10.34190/EJEL.20.18.1.002

Abstract: This paper presents a model for developing research questions that are aligned to research aims for research design in e-learning. The model is proposed as a solution to the on-going problem of heterogeneity of research problems. The model is based on Burrell and Morgan's four social paradigms, and integrates four research aims, namely, explore, explain, develop and describe; four design positions, namely, formalist, populist, functionalist and conventionist; and four pursuits of (hu)mankind, namely, virtue, value, power and knowledge. Four of Roode's (1993) research questions are mapped onto each of the consolidated paradigms. The feasibility of the model was tested against eight papers in previous issues of this journal. Two questions drove the study: what are the paradigms in which the selected articles can be classified, and how are these paradigms aligned to the research aims and research questions? The model was found to be useful in aligning the implied research aims and research questions of the selected papers. The model is proposed as a useful tool for supervisors and novice researchers to assist with the development of integrated research aims and research questions. Further research will include the development of generic question stems that can be used as the first few words of the questions that correspond to each aim.

Keywords: Research paradigm, research aims, research questions, design research

1. Introduction

In a recent volume of this journal two authors call for a "critical reflective approach to researching technology use" (Charbonneau-Gowdy, 2017, p.59) and propose "first steps that facilitate to overcome the heterogeneity of e-learning projects in favor of a better comparability and generalizability being necessary preconditions for theory development" (Rüth and Kaspar, 2017, p.94). There seems to be a lack of clarity in terms of what is being researched, as well as in how it is being researched. Somehow the stated aim of a research project does not match the eventual outcome. A key reason for this may be a mis-alignment of research aims and research questions. This article argues that the paradigm of educational design research (McKenney and Reeves, 2018) is a useful starting point for socially responsible research. The paper presents a framework for developing research questions that aligns research aims, research questions and the underlying beliefs of researchers regarding their research. The model is presented and tested against a number of articles in this journal to gauge its feasibility towards providing such improved "comparability and generalizability" (Rüth and Kaspar, 2017, p.94).

The call for (socially) responsible research in educational technology is not new and a notable contribution has been made over the years by Tom Reeves and others. (Reeves, 1995, 2000, 2006; McKenney and Reeves, 2018; Reeves, Herrington and Oliver, 2005; Oliver, Herrington and McKenney, 2011). They take as their point of departure research that is both grounded in theory and aimed at practical usefulness, thus fitting into what Stokes (1997, p.73) calls "Pasteur's quadrant" (Figure 1.). The figure shows that research can be high in considerations of use, or in considerations of fundamental understanding, or high in both, but the forth quadrant remains empty such as no research can be low in both use and understanding.

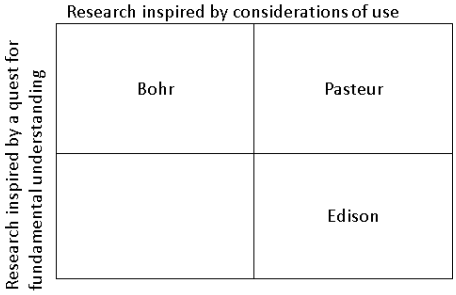

Figure 1: Pasteur's quadrant (Stokes, 1997, p.73)

Reference this paper: Cronje, J. C., 2020. Designing Questions for Research Design and Design Research in e-Learning. *The Electronic Journal of e-Learning,* 18(1), pp. 13-24, available online at www.ejel.org

The challenge now, though, is to determine what type of research would fit into Pasteur's quadrant and to develop a framework for generating questions within that quadrant. This article will present a model that considers four research paradigms and will link those paradigms to a set of research questions where there are two questions to each research aim. The feasibility of the model will then be tested against purposively selected articles from past volumes of this journal. The aim of the research is to explore the extent to which the selected articles can be classified into research paradigms, and to propose linked research questions for each article. Two questions drive the study:

1. What are the paradigms in which the articles can be classified? and
2. How are these paradigms aligned to the research aims and research questions?

The problem that is addressed by this model lies in the alignment of research aims and research questions. Novice researchers in particular often state a research aim and then mention a number of questions, but there is no clear link showing how answering those questions will lead to achieving the aim.

2. Literature survey

For Reeves, Herrington and Oliver "...at some level, all instructional technology research can be said to focus on questions of how people learn and perform, especially with respect to how learning and performance are influenced, supported, or perhaps even caused by technology" (Reeves, Herrington and Oliver, 2005, pp.100–101). They identify the following six characteristics of design research:

1. a focus on broad-based, complex problems critical to higher education, focus on broad-based, complex problems critical to higher education;
2. the integration of known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems;
3. rigorous and reflective inquiry to test and refine innovative learning environments as well as to reveal new design principles;
4. long-term engagement involving continual refinement of protocols and questions;
5. intensive collaboration among researchers and practitioners; and
6. a commitment to theory construction and explanation while solving real-world problems.

(Reeves, Herrington and Oliver, 2005, p.103)

In framing socially responsible research in educational technology it may be useful to draw from one of the key works underpinning the closely aligned field of information systems, which also studies the relationships between technology and society. For many years the work of Burrell and Morgan on *social paradigms and organisational analysis* has underpinned much of the philosophical approaches to research in information systems. Burrell & Morgan (1979) identify two dimensions along which social science research is conducted. The dimensions are developed from our *beliefs* about the nature of social science and the epistemological and ontological nature of society. The epistemological and ontological nature of social science research varies between positivist and anti-positivist. The nature of society varies from a society of regulation to a society of radical change. Burrell and Morgan place these two dimensions at right angles and thus create a two-by-two matrix of four paradigms, namely, Radical humanist, Interpretive, Functionalist, and Radical structuralist (Figure 2).

Given that one cannot be subjective and objective at the same time, nor support radical change and regulation simultaneously, "the four paradigms are mutually exclusive. They offer alternative views of social reality, and to understand the nature of all four is to understand four different views of society. They offer different ways of seeing. A synthesis is not possible, since in their pure forms they are contradictory, being based on at least one set of opposing meta-theoretical assumptions. They are alternatives, in the sense that one can operate in different paradigms sequentially over time, but mutually exclusive, in the sense that one cannot operate in more than one paradigm at any given point in time, since in accepting the assumptions of one, we defy the assumptions of all the others" (Burrell and Morgan, 1979, p.25).

I argue that researchers should select a particular paradigm within which to work depending upon the subjective or objective *aim* of their research (Figure 3). *Radical humanists* are interested in the subjective world, but feel the need to transcend or even overthrow current societal arrangements.

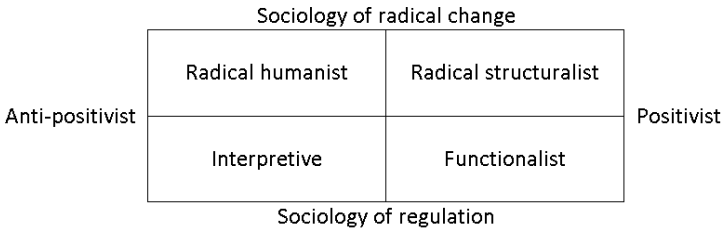

Figure 2: Four quadrants of sociological and organizational research (Burrell and Morgan, 1997, p. 25)

Their aim is to *uncover* hidden patterns and to *explore* alternatives. Interpretive researchers believe that the human experience of the world is subjective, and they have a concern to understand it as it is. Their aim is to *understand* given phenomena. However the word *understand* is not demonstrable. A researcher cannot stand up and *understand* something for the audience (or the reader) to see. It is therefore better to use the word *explain* as the keyword for this paradigm. Functionalists believe that the world is objectively discoverable, and that things can be improved by 'tightening up' the rules. Their aim is to *develop* solutions. Radical structuralism takes an objective world view. They concentrate on structural relationships, believing that radical change is built into the very nature of society. Their aim is to *describe* the position as it is.

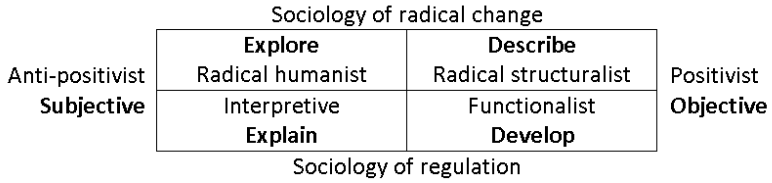

Figure 3: The aim of each paradigm

The work of Burrell and Morgan has not been without criticism, notably from critical realists (Modell, 2015) who argue against the hegemonic dominance of the model, particularly with its emphasis on the exclusivity of the paradigms, and from pragmatists (Goldkuhl, 2012) who argue for more nuanced approaches to the study of complexity. On the other hand Garbutt (2016) sees the different paradigms as different routes on a map. The map provides information rather than judgement and it is for the traveller who has selected a particular route on the map to follow the instructions that go with that route.

Garbutt (2016) adds an axiological dimension of what I shall call *concern* to the use of the four quadrants. He maps them onto Ackoff's (1976) four pursuits of humankind, viz. the scientific – the pursuit of (scientific) truth; the political-economic – the pursuit of power and plenty; the ethical-moral – the pursuit of goodness and virtue; and the aesthetic – the pursuit of beauty (as a value) (Ackoff, 1978, p.14). Garbutt's resultant mapping sees four pursuits of researchers (figure 4) – Radical structuralism, he argues, is in pursuit of objectively measurable power while the functionalists look for objective, scientifically measurable knowledge. Interpretive researchers are in search of subjective, concrete value, and radical humanists seek an abstract, subjective virtue (Garbutt, 2016, p.5).

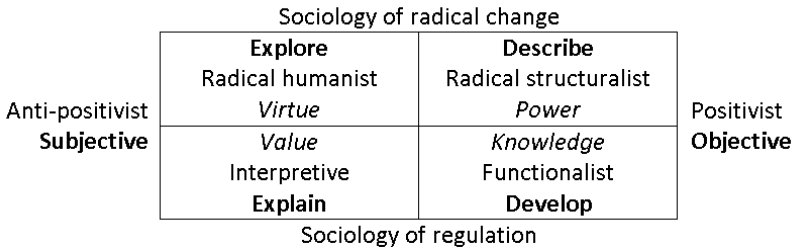

Figure 4: Adding the four pursuits of human kind

Anchoring Burrell and Morgan's (1979) four paradigms in some form of scientific pursuit or another allows one to see the extent to which research in any one of them might be considered socially responsible. What remains now is to consider the relationship between these research paradigms and the process of design. In his seminal work on *Design Thinking* Peter Rowe (1987) presents a framework of four design positions that

architects take in their design of spaces. "First there is a *functionalist* position, distinguished by an emphasis on the accommodation of activities and the influence of building technology. The second is a *populist* position, which acknowledges and interprets contemporary commonplace building practices and user preferences. Third, there is a *conventionist* position, that uses a primarily historical reference; and finally, a *formalist* position that considers elements of form for their own sake" (Rowe, 1987, p.124). Although Rowe's work uses architecture as its primary reference it can be argued that it is applicable to all design, including instructional design.

I argue that Rowe's four positions map directly onto Burrell and Moran's (1979) paradigms (Figure 5). The horizontal dimension relates to the existence or absence of a "best solution". At the one extreme of the dimension is the conventional belief that there is one implied best solution to a problem and that regardless of whether or not that solution can be achieved, reaching it remains the ultimate functional goal. At the other extreme is the belief that there may be an infinite number of solutions and that these solutions are dependent on an infinite number of contexts. These contexts could relate to people (populist) or to form (formalist).

The vertical dimension relates to the abstract or concrete nature of the design problem or message. At the abstract extreme lies the formalist desire to follow the possibilities that the form presents, and the conventionist practice of using a set of abstractions that have developed over time. At the concrete extreme lies the practical reality of popular acceptance or functional use.

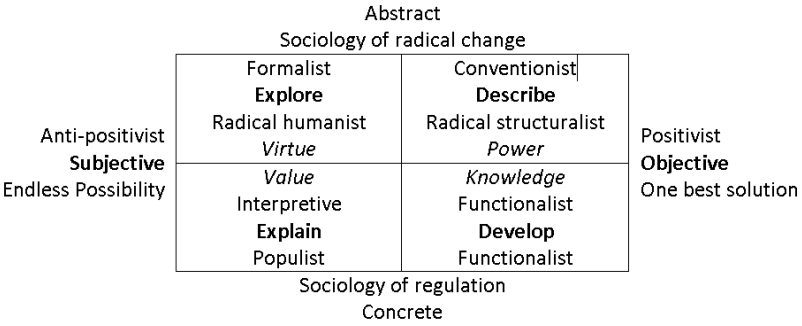

Figure 5: Adding the four design positions – developed from Rowe, 1978

3. The conceptual model – adding the questions

Having now developed a conceptual model to integrate aims I move towards presenting a set of research questions that relate to each paradigm (Figure 6). For this I draw from Roode (1993), who argues that research questions and methods can be developed for each of the paradigms. He identifies four research questions that could be asked: 'What is; how does; why is; and how should?' Although Roode does not say so himself I believe that his questions map directly onto Burrell & Morgan's (1979) model. 'How should?' is an essentially positivist question that calls for an objective, prescriptive answer, while 'How does?' resonates with the subjectively descriptive, interpretive nature of the anti-positivist. 'What is?' relates to a society of radical change as it tries to uncover or take an abstract stance to a situation, while 'Why is?' tries to understand what the rules are trying to achieve in a society of regulation. The problem with a question such as 'How should?' is that it may lead to spectulation, and specifically in an objective environment one would prefer to have a question of a more strongly binary nature. I therefore propose that the question 'How should?' be replaced by 'When does?' To clarify, an example. The question 'How should A be aligned with B?' is more difficult to answer than 'When does A align with B?' The second question is clearly a research question, while the first may be regarded as speculative. For the purposes of this article therefore the question 'When…?' refers to some kind of measurement, and could be replaced with "To what extent…?' So the question could also be 'To what extent does A align with B?'.

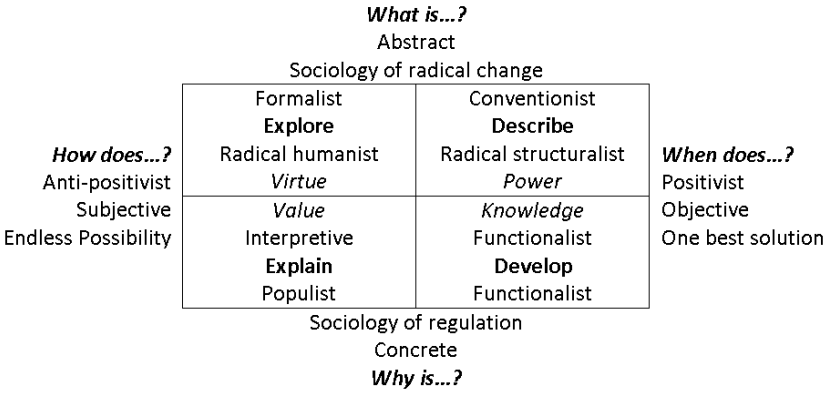

Figure 6: Four research questions aligned to the research aims, paradigms, human pursuits and design perspectives

3.1 A worked example

The purpose of the model presented above is to align research aims, paradigms, pursuits and design positions with research questions. In the following section I shall use the recurring theme of technology acceptance in e-learning to show how this model might be used to generate research questions for each paradigm. The key to this method is to use two research questions to arrive at a given aim. So if the aim is to *explore*, the questions will be: 'What is (or are)?' and 'How does (or do)?' Likewise if the aim is to *explain* the questions would be 'How does (or do)?' and 'Why is (or do)?' To *develop* one needs to ask 'Why is (or why is this not…)?' and 'When does (or when will)?' Finally to describe one needs to ask 'What is?' and 'When does (or when do)?'

A researcher working in the Radical Humanist quadrant may wish to *explore* the patterns of adoption that have emerged in a given area or field. The two questions that drive the research could then be something like: '*What are* the affordances of the technology that is currently infused into the system,' and '*how do* teachers apply these affordances in their practice?' On the other hand someone working in the interpretive quadrant wants to understand why certain patterns of adoption emerge. The aim of such research is to *explain* the patterns of adoption of the affordances of technology in a given area or field. The two questions would be '*How does* this technology get adopted in the field, and *why does* it get adopted in this way?' The implementer tasked with user adoption may want to *develop* an implementation plan and would ask '*Why do* some teachers adopt this technology faster than others and *when do* the slow adopters also start using the solution?' Finally, as is the case in evaluation studies, the aim of research would be to *describe* the state of the implementation of a given technology. The questions would be "*what is* the state of adoption in this area and *when is* this state reached?'

The worked example has shown how four discrete research projects could be undertaken, from four different design perspectives, in four different research paradigms, around the same theme and potentially using the same population and data set. It is simply the questions that change as the research aim changes. The following section will show how these questions can be used to drive design research in our field.

3.2 Application of the model to design research

Roode (1993) argues that research could take place sequentially through each paradigm to form a framework for what he calls *process-based* research. One form of process-based research that has gained some traction in the field of educational technology has been that of design research (Reeves, Herrington and Oliver, 2005; Oliver, Herrington and McKenney, 2011; McKenney and Reeves, 2018). Design research follows a cyclical approach (McKenney, 2011) in which a problem is analysed, a solution designed, implemented and tested, and the results used to inform a second, third and even fourth cycle of design and development (figure 7).

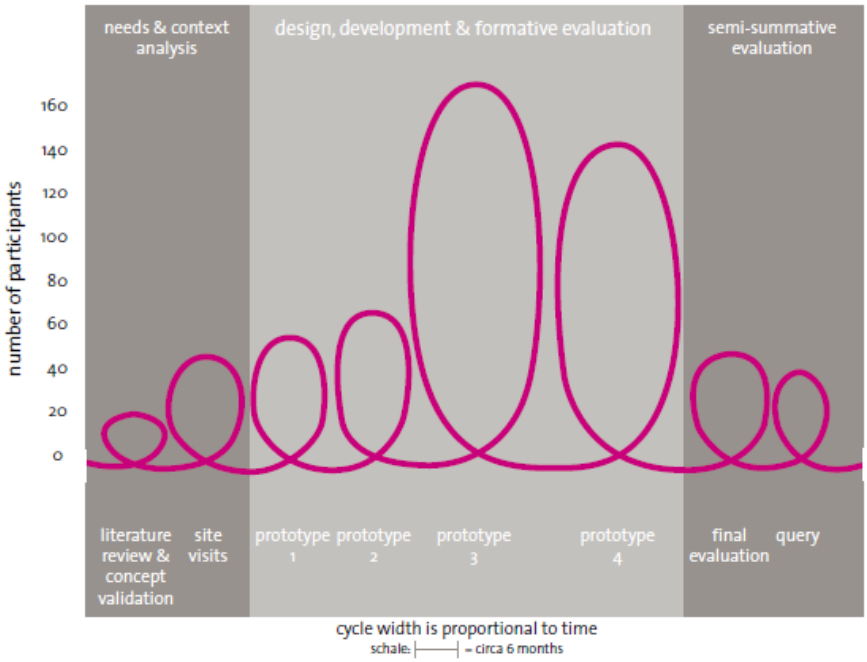

Figure 7: A typical design research cycle (McKenny, 2001)

Van den Akker (2007, pp.45–46) presents a staged model of design research: *Preliminary investigation, Theoretical embedding, Empirical testing;* and *Documentation, analysis and reflection on process and outcomes,* which elaborates on what happens during each cycle*. Preliminary investigation* amounts to an exploration of terrain, and would therefore map onto the Radical humanist *Explore* paradigm. Since a theory is meant to explain, the *Theoretical embedding* phase would map onto the interpretive *Explain* paradigm, while *Empirical testing* amounts to *development*. Finally the *Documentation, analysis and reflection on processes and outcome,* maps directly onto the Radical structuralist *Describe* quadrant.

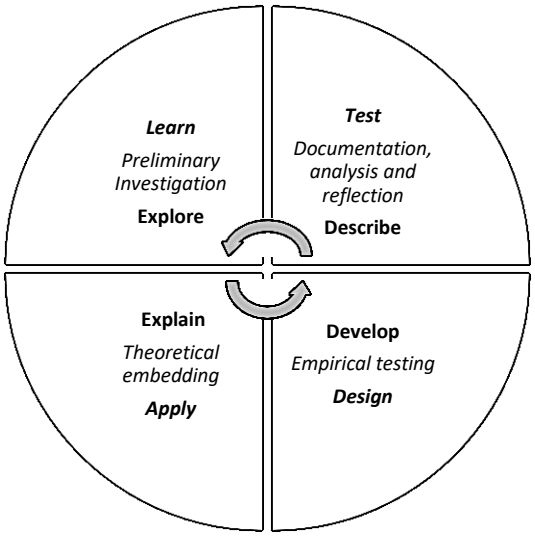

Figure 8: One iteration of the design research cycle

I propose a simplified version of this model to include four stages called, *Design, Test, Learn* and *Apply.* A design cycle comprises a single anti-clockwise rotation through the four paradigms as shown in Figure 8. A couple of turns of the wheel will result in a design project. The model Figutr 9. shows how design research is a combination of designing and researching. The outcome of the design process is usually some physical, digital or intellectual product, while the outcome of the resultant learning is a set of principles that would lead to a research outcome such as a thesis or a paper.

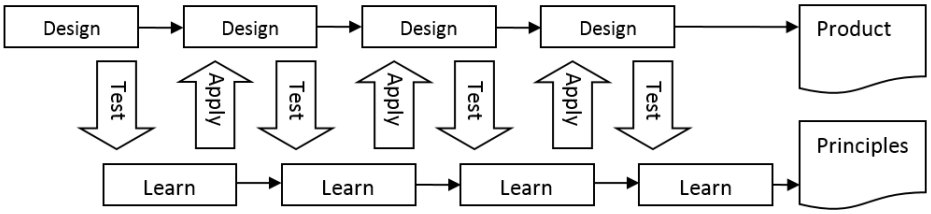

Figure 9: Design, Test, Learn, Apply - the design research process

4. Method

In the following section I will test the model against a number of selected papers published in earlier issues of this journal. The aim of this research was to explore the extent to which selected articles in this journal conform to the model. Two questions drive the study: What are the paradigms in which the articles can be classified, and how are these paradigms aligned to the research aims and research questions? In this desk study the articles were selected by way of a type of purposive sampling, known as Typical Case Sampling, which "is useful when a researcher is dealing with large programs, it helps set the bar of what is standard or 'typical'" (Etikan, Musa and Alkassim, 2016, p.4).The sampling was done by performing a close reading of the titles in the tables of contents of all the volumes of the journal. The criterion for including a paper in the research was that the title of the article had to provide an indication of the paradigm in which the research took place. For instance the title: "Familiarity with technology among first-year students in Rwandan tertiary education" (Byungura et al., 2018) suggests that the article would *Describe* the familiarity of the students and thus fall in the Radical Structuralist/Describe quadrant. On that basis the article was selected. Once the articles were selected their abstracts were considered to confirm if a paradigm may be clearly derived from these.

Articles whose abstracts were acceptable were then read and analysed to extract the aim and research questions. In some cases the aims and questions were explicitly stated, and in other cases they had to be derived from the context. In some cases the authors may have used the word 'understand' when, in the context of this paper the word 'explore' may have been more appropriate. Likewise authors may have used 'explore' to mean 'describe' in such cases the words were changed and the changes indicated in the discussion. The research aim and research questions may be my own paraphrase of the stated or implied aims and questions of the relevant paper. The next section will first discuss papers that work in a single paradigm. Thereafter will follow a paper in which the entire design
research sequence was followed.

5. Discussion of results

In this section I will discuss a number of papers in this journal and show how their aims and research questions may be aligned to fit into each paradigm of the model described above. Finally a paper will be discussed that shows how its authors moved through all four paradigms in a typical design research cycle.

5.1 Explore

In the abstract of her article about "seeking solutions to challenges in online and blended learning programs" Paula Charbonneau-Gowdy states her work to be "directed at *uncovering* challenges in Virtual Learning Environments" (Charbonneau-Gowdy, 2018, p.56 - My emphasis). The aim of uncovering underlying patterns places the work in the Radical humanist quadrant with the aim to *explore.* Charbonneau-Gowdy's own explicitly stated research questions resonate with that aim. She presents three questions:

1. What tools are available that could help evaluate our online programs?
2. In what ways, if at all, do our research findings align with the framework of such a tool?
3. What solutions, if any, can this framework offer for moving forward in order to respond to the tensions we have uncovered in the online programs? (Charbonneau-Gowdy, 2018, p.57).

Charbonneau-Gowdy provides two 'What are…?' questions, while her second question, "In what ways…" (p.57) can be paraphrased as "How, if at all…". Thus we see that in this case the aim of the article – to uncover, or to explore, is supported by two what questions and a how.

One of the stated aims of Knight and Barbera is to "explore how learners are navigating with current and emerging technologies in language learning tasks" (Knight and Barbera, 2018, p.67). They complement this with a two-fold research question: "Is there evidence of directional agency manifesting in other recent or emerging task-based language learning CALL scenarios that involve talk, and if so how?" (Knight and Barbera, 2018, p.72). Given that if the answer of the first part of the question is 'no', then there would be no second part, a better formulation of the question would be 'What evidence is there…' If such a change is made then the research aim, to explore, is well aligned with the research questions 'What is… and how do…?"

Sánchez-Mena, Martí-Parreño and Aldás-Manzano state that "the main goal of this research is to explore teachers' intention to use EVGs using the technological approach proposed by the Technology Acceptance Model" (2017, p.356). In their research the authors test seven hypotheses to explore the relationship between age, perceived usefulness and perceived ease of use, and attitude towards and intention to use educational video games. Although they present their hypotheses they do not formulate explicit research questions, although these can be extrapolated from the research to have been 'What are the relationships between age, perceived usefulness and perceived ease of use, and how do these affect attitude towards and intention to use educational video games. Once again an article with the aim to explore, that answers 'What is, and how does...?' types of questions.

5.2 Explain

Costley and Lange did their research because "it is useful to understand the reasons why students decide to continue using MOOCs in the future" (2017, p.174). Instead of research questions they test four hypotheses:
H1. Levels of instructional design are positively correlated with future behavioral intentions.
H2. Levels of instructional design are positively correlated with germane load.
H3. Levels of germane load are positively correlated with levels of future behavioral intentions.
H4. The effect of instructional design on future behavioral intentions is mediated by germane load. (Costley and Lange, 2017, p.175).

From these hypotheses I extrapolate a number of research questions:

1. What is the relationship between levels of instructional design and future behavioural intentions?
2. What is the relationship between levels of instructional design and germane load?
3. What is the relationship between levels of germane load and levels of future behavioural intentions? and
4. Why does instructional design affect future behavioural intentions?

It can be seen, then, that the aim to *understand* or *explain* in this instance, is refined, as the model proposes, by '*What…?'* and '*Why…?'* questions. However, it is necessary to replace the words "What is the relationship, with "How are these elements related", so that the questions are aligned with the "How?" and "Why" questions that are appropriate for this paradigm.

5.3 Develop

Lawless and Allen's paper "investigates methods of reducing stress on-line and proposes some principles for constructing on-line collaborative events to ensure that stress is eliminated or at least minimised" (2004, p.121). The aim of the research, therefore was to develop a set of guidelines, thus putting it in a functionalist paradigm. The resultant paper is clearly structured to answer two implied research questions, which are (my formulation) 'why do students in an online course experience stress and under what circumstances (when) will this stress be reduced?' They answer the first question through an extensive literature survey coupled with some interaction with students. The second question is answered through a case study in which they construct some stress-reducing exercises for their students and test the efficacy of these on the students. The end product is a set of guidelines for reducing stress in on-line learning.

5.4 Describe

The following paper aims to describe the perspectives of an instructor and students on the use of the *Blackboard* platform for delivering an engineering course over a period of nine years. Although the aim is never explicitly stated it can be derived from the sentence: "The results presented *show* students and instructor perspective towards use of LMS as a technology enhancing learning and teaching tool" (Uziak et al.,

2018, p.3 - My emphasis). The word *show* is sufficiently close to describe to infer such an aim. Similarly there are no explicitly stated research questions, but again they can be deduced from the results as being: 'What are the affordances of the Blackboard platform used by the instructor and students?' and 'When do the students and instructor find these tools satisfactory?' At this stage it needs to be pointed out that the word *when* is a statement of condition, not of time - it could also be paraphrased as 'under what circumstances?'

As I pointed out earlier in this paper the aim: '*to explain*' is used as an indicator for *understand* in the interpretive paradigm. Therefore a paper that "aims to understand the degree of familiarity with technology for first-year students at the University of Rwanda" (Byungura et al., 2018) is likely to fall into this paradigm. They state their research questions explicitly as: "(1) To what extent do first-year university students owned, accessed and used a range of digital tools? (2) What activities do these students perform with these digital tools? (3) Did these students get any previous computer-based training? (4) What is their level of confidence in using a range of digital tools?" (Byungura et al., 2018, p.32). As can be seen there are no 'How…?' or 'Why…?' questions here. Thus one questions the interpretive nature of the research. Furthermore a careful further reading of the research methods shows that a questionnaire, rather than interviews of focus groups, was used to gather data. The method thus suggests a descriptive, rather than an interpretive study. A full reading of the paper confirms this. The findings amount to descriptive statistics of ownership and use. It is clear that the authors of this paper substituted the word "understand" for the more correct "determine" and the aim of the paper is to *describe,* rather than to understand or explain. It will only be once researchers have interrogated these results further and augmented them by other interpretive methods that they would arrive at a true understanding.

5.5 One full research cycle

The aim of a paper by Věra Ferdiánová is "to introduce interactive materials for Monge projection, which are implemented into LMS Moodle, as well as show results of pilot research of influence of using these materials on students" (Ferdiánová, 2017, p.259). In her paper she refers to previous work (Ferdiánová and Poruba, 2016) in which a paper-based version was demonstrated, and at the end of the paper she discusses future development. It is clear, therefore, that the article under discussion is the description of one cycle in a design research process. The paper actually passes through five stages, *Describe, Explore, Explain, Develop,* and *Describe* again.

In the introductory sections of her paper she *describes what* some current problems are with three-dimensional visualisation and *when* (or under what circumstances) these problems are addressed by other researchers. She then goes on to *explore what* some current solutions are, and *how* they are being used, before coming to the conclusion that "All these approaches seem to be very enriching. Unfortunately, they have not been statistically tested yet – it cannot be statistically confirmed, which of these methods is more effective or brings more benefits" (Ferdiánová, 2017, p.260). Once she has identified a possible solution she continues to develop an *understanding* of *how* anaglyphic stereograms work, and *why* they might hold the key to developing a solution for students to practice three-dimensional visualisations in a digital, rather than physical analogue environment (**Figure 10**).

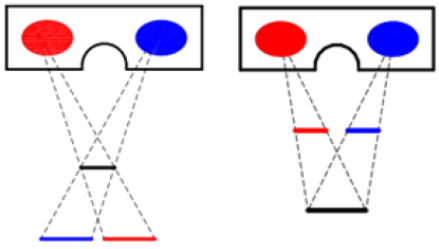

Figure 10: Orthoscopic (left) and pseudoscopic (right) anaglyphic views (Ferdiánová, 2017, p.260)

After the discussion of the potential solution she goes on to *develop* and implement digital alternatives using *GeoGebra*. The first phase of the development is to ascertain *why* GeoGebra is an appropriate platform. She does so by discussing the advantageous features of the program and also by listing some of the prestigious awards it received. Following this she develops a set of interventions for *when* these may be appropriate (Figure 11).

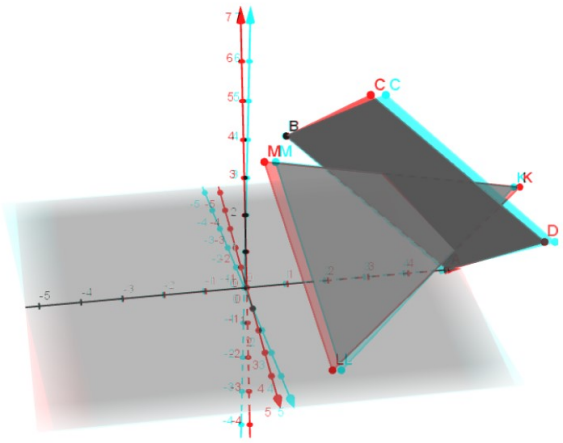

Figure 11: An anaglyph created by GeoGebra during the development phase (Ferdiánová, 2017, p.264)

The penultimate section of the article is where she *describes* the results of a pilot test of the intervention, where, with the aid of graphs and tables, she indicates *what* the results were of the students' learning, and *when* these results showed an improvement over previous iterations.

This section thus shows how, in one article, Ferdiánová has taken us through the 'Design, Test, Learn, Apply' cycle, working sequentially through each of Burrell and Morgan's (1979) paradigms of social science, and asking and answering Roode's (1993) questions as appropriate for each paradigm. Finally, in the last section of her article she states categorically that "These results are motivation for us for our future work, because we would like to test the biggest group and would like to extend materials" (Ferdiánová, 2017, p.267), thus indicating that she and her fellow researchers are about to embark upon another design research cycle as described by McKenney (2011).

6. Conclusions and recommendations

In this paper I have proposed a model that aligns research aims with research questions for research in e-learning. The model is based on Burrell and Morgan's (1979) four social paradigms, and integrates my own four research aims, namely, explore, explain, develop and describe, Peter Rowe's (1987) four design positions, namely, formalist, populist, functionalist and conventionist, Ackoff's (1978, 1976) four pursuits of (hu)mankind as refined by Garbutt (2016) as virtue, value, power and knowledge. To this synthesis I added a modification of four of Roode's (1993) questions for research in information systems, and argued that, a selection of two specific questions were appropriate for each of the consolidated paradigms, as described in Table 1.

Table 1: Consolidation of the model

Burrell and Morgan	Cronje	Rowe	Ackoff/Garbutt	Roode
Radical Humanist	explore	formalist	Virtue	What is…? How does…?
Interpretive	explain	populist	Value	How does…? Why does…?
Functionalist	develop	functionalist	Power	Why does…? When does…?
Radical structuralist	describe	conventionist	knowledge	When does…? What is…?

The model was tested against eight Typical Case Sampled articles from this journal and it was found that it was possible to classify the articles into each of the four paradigms respectively, and that the articles answered research questions that corresponded to the mapping of Roode's (1993) questions onto the model. It was found, however, that authors use the terms *understand, explore, interpret* etc. rather loosely and it was necessary to re-interpret those terms and substitute them with the words *explore, explain, develop* and *describe.* Such an interpretation was quite possible through a close reading of the article itself. It was also found that few authors provide clear, answerable research questions, some providing only hypotheses, and others simply hinting at what they were trying to find. Once again, though, through close reading it was possible to generate questions that conform to Roode's (1993) question stems. I contend that, should authors

be more careful in their selection of aims and research questions, the resultant higher level of standardisation will reach to easier comparisons across articles.

Along with Roode (1993) I argued further that, in the context of design research, it was possible to work through the four paradigms sequentially, following a cyclic path as proposed by McKenney (2011) that amounted to a sequence of *design, test, learn* and *apply.* Once again this model was tested against an article in a volume of this journal (Ferdiánová, 2017) and it was seen that, although she did not explicitly use the research aims or questions, these could be derived from a close reading of the article itself.

To conclude then, the model seems to work well in making explicit the relationship between research aims and research questions and could be useful in describing socially responsible research. A number of recommendations follow. These recommendations are aimed at supervisors and novice researchers who wish to speed up the proposal writing process.

Firstly in order to make research aims explicit and easy to comprehend researchers are encouraged, at proposal stage, to use one of four words to describe the aim of their research, viz. explore, explain, develop or describe. It is always possible later in the research process to substitute these verbs for more nuanced words such as ascertain, understand, design, or evaluate, but to develop a crisp research proposal it helps to use simple words at the start.

Secondly two research questions should be developed that match the relevant paradigm as shown in **Error! Reference source not found.**. Once again, as the research progresses these question stems could be refined and replaced, but for an initial crisp proposal it helps to use the most basic form of the question stem. It is hoped that, should there be a greater standardisation of the terminology of paradigms, aims and objectives the much needed "comparability and generalizability" (Rüth and Kaspar, 2017) will be improved.

Finally, in the case of a design research project where a certain solution is both developed and tested it is useful to follow a cyclic path though all four paradigms, in which the problem is described, possible solutions explored, the most feasible route understood and a solution developed, after which the test results are once again described, thus forming both the conclusion of the first cycle and the point of departure of the next.

7. Limitations and further work

With only eight articles sampled this study amounts to a "proof of concept" rather than a large-scale interpretive study. Empirical verification of the model could be done by training a number of critical readers to scrutinise a particular canon and classify the texts accordingly. One could then determine the level of inter-rater validity to see the extent to which the model is transferrable between readers.

A further limitation of the model lies in the fact that the terms are so open to interpretation. As was shown in the case of Costley and Lange (2017) it was necessary to change the words *What is the relationship between x and y* to *How are x and y related.* To clarify these it would be useful to develop a number of typical *What* question stems, typical *How* question stems, etc. Novice researchers could then be encoutage to use such question stems in the development of their initial proposals. Obviously as students' proficiency in understanding the relationships between research aims and questions develop they could use a completely different phrasing. In this way, for instance, the question *When does?* could be replace by *Under what circumstanses does?*

Finally it must be remembered that this model is designed to be an initial tool to assist researchers to develop a clear relationship between their research aims and questions – it is not to be seen either as a recipe or a rigid rule for the development of research questions.

References

Ackoff, R.L., 1976. Does quality of life have to be quantified. Operational Research Quarterly, 27(2), pp.289–303.

Ackoff, R.L., 1978. The art of problem solving: ccompanied by Ackoff's Fables. New York, NY : Wiley.

Van den Akker, J., 2007. Curriculum design research. In: T. Plomp and N. Niveen, eds., An introduction to educational design research. Amsterdam: SLO.

Burrell, G. and Morgan, G., 1979. Sociological paradigms and organisational analysis. London: Heinemann.

Byungura, J.C., Hansson, H., Muparasi, M. and Ruhinda, B., 2018. Familiarity with technology among first-year students in Rwandan tertiary education. Electronic Journal of e-Learning, 16(1), pp.30–45.

Charbonneau-Gowdy, P., 2017. Moving outside the box: researching e-learning in disruptive times. Electronic Journal of e-Learning, 15(1), pp.59–69.

Charbonneau-Gowdy, P., 2018. Beyond stalemate : seeking solutions to challenges in online and blended learning programs. Electronic Journal of e-Learning, 16(1), pp.56–66.

Costley, J. and Lange, C., 2017. The mediating effects of germane cognitive load on the relationship between instructional design and students' future behavioral intention. Electronic Journal of e-Learning, 15(2), pp.174–187.

Etikan, I., Musa, S.A. and Alkassim, R.S., 2016. Comparison of convenience sampling and purposive sampling. American ournal of Theoretical and Applied Statistics, 5(1), pp.1–4.

Ferdiánová, V., 2017. GeoGebra materials for LMS moodle focused Monge on projection. Electronic Journal of e-Learning, 15(3), pp.259–268.

Ferdiánová, V. and Poruba, J., 2016. Special 3D models for Monge Projection. In: 15th Conference on Applied Mathematics, Proceedings,. Bratislava: Slovak University of Technology in Bratislava.

Garbutt, M., 2016. Disciplinary kingdoms and the pursuit of pragmatism in research: a student perspective. Electronic Journal of Information Systems in Developing Countries, 77(1), pp.1–10.

Goldkuhl, G., 2012. Pragmatism vs. interpretivism in qualitative information systems research. European Journal of Information Systems, 21(2), pp.135–146.

Knight, J. and Barbera, E., 2018. Navigational acts and discourse : fostering learner agency in computer-assisted language learning. Electronic Journal of e-Learning, 16(1), pp.67–76.

Lawless, N. and Allen, J., 2004. Understanding and reducing stress in collaborative e-Learning. Electronic Journal of e-Learning, 2(1), pp.121–128.

McKenney, S., 2011. Computer-based support for science education materials developers in Africa: exploring potentials. Enschede: University of Twente.

McKenney, S. and Reeves, T.C., 2018. Conducting educational design research. New York, NY: Routledge.

Modell, S., 2015. Theoretical triangulation and pluralism in accounting research: a critical realist critique. Accounting, Auditing & Accountability Journal, 28(7), pp.1138–1150.

Oliver, R., Herrington, J. and McKenney, S., 2011. Design-based research and doctoral students : Guidelines for preparing a dissertation proposal. Perth: Edith Cowan University.

Reeves, T.C., 1995. Questioning the questions of instructional technology research. In: Proceedings of the 1995 Annual National Convention of the Association for Educational Communications and Technology (AECT), (17th, Anaheim, CA, 1995); see IR 017 139. ERIC.

Reeves, T.C., 2000. Socially responsible educational technology research. Educational Technology, 40(6), pp.19–28.

Reeves, T.C., 2006. Design research from a technology perspective. In: Educational design research. New York, NY: Routledge, pp.64–78.

Reeves, T.C., Herrington, J. and Oliver, R., 2005. Design research: a socially responsible approach to instructional technology research in higher education. Journal of Computing in Higher Education, 16(2), pp.97–116.

Roode, J.D., 1993. Implications for teaching of a process-based research framework for information systems. In: L. Smith, ed., Proceedings of the 8th Annual Conference of the International Academy for Information Management. Orlando, Florida.

Rowe, P., 1987. Design Thinking. Cambridge, MA: The MIT Press.

Rüth, M. and Kaspar, K., 2017. The e-learning setting circle: first steps toward theory development in e-learning research. Electronic Journal of e-Learning, 15(1), pp.94–103.

Sánchez-Mena, A., Martí-Parreño, J. and Aldás-Manzano, J., 2017. The effect of age on teachers' intention to use educational video games: A TAM approach. Electronic Journal of e-Learning, 15(4), pp.355–366..

Stokes, D.E., 1997. Pasteur's quadrant: basic science and technological innovation. Washington, DC : Brookings Institution Press.

Uziak, J., Oladiran, M.T., Lorencowicz, E. and Becker, K., 2018. Students' and instructor's perspective on the use of blackboard platform for delivering an engineering course. Electronic Journal of e-Learning, 16(1), pp.1–15.