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RESEARCH ARTICLE

Paradigms revisited: a quantitative investigation into a model to integrate objectivism and constructivism in instructional design

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Abstract While learning interventions were traditionally classified as either objectivist or constructivist there has been an increasing tendency for practitioners to use elements of both paradigms in a consolidated fashion. This has meant a re-think of the two perspectives as diametrically opposite. A four-quadrant model, first proposed in this journal was tested to see to what extent instructional design practitioners were, in fact, integrating elements of both paradigms into a single learning event. After a pilot and a main study involving 214 designers it was found that all their courses did, in fact present somewhere in the four quadrants of the matrix, rather than to fall on a supposed straight line. The results of this study show that the matrix may be useful in describing the choices made by instructional designers when they select elements of instructional design.

Keywords Constructivism · Construction · Instructional design · Immersion · Objectivism · Injection · Instruction

Introduction

In this journal, in 2006 Johannes Cronjé proposed the integration of two seemingly opposing pedagogical approaches into a single model (Cronje 2006). The argument was that the constructivist approach to instructional design was not diametrically opposed to what has been called traditional, instructivist, objectivist or even behaviorist approach. The one does not exclude the other. (For the sake of brevity this paper will use the term "objectivist" to represent the opposite of the constructivist approach. While we recognize

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that there are a multitude of descriptors, arriving at a conclusive definition lies outside of our scope.) Experience has shown that people use both approaches depending on various circumstances. When the two approaches are placed at right angles four quadrants emerge. One is low in both approaches, one is strongly constructivist, one is strongly objectivist and one is high on both counts. The purpose of this article is to provide an update of developments since the introduction of the model and in particular to report on a quantitative study of its feasibility.

The model has been used by several authors in analyzing and describing their practices (Pollalis and Mavrommatis 2009; Voigt 2008; Wei et al. 2011). In some instances the four-quadrant model was used to classify certain learning experiences such as an open-access learning portal (Cronjé and Burger 2006) and notably in the discussion of e-learning as a cultural artifact (Masoumi and Lindström 2012). There have also been similar findings and calls for further investigation: In studying hospitality management students' perceptions about structured and unstructured learning tasks researchers have found "a significant negative correlation between the constructivist and the traditional dimension … which is an indication that both dimensions can neither be seen as opposite ends of a continuum nor as fully complementary, leaving us with an unresolved issue demanding further exploration" (Otting and Zwaal 2011, p.11).

One such "further exploration" was conducted by Kelly Elander (2012) who set out to test, by way of a quantitative survey, the extent to which instructional designers, course developers and instructors were actually integrating the two dimensions and to determine the feasibility of the model. We report the key findings here in response to a suggestion by van Merriënboer and de Bruin that "researchers should always have an open mind for research based on competing theories and paradigms, because radically new ideas and perspectives will most likely develop at the interface between paradigms" (2014, p. 28).

Background

It could be argued that the debate between direct instruction and indirect learning is as old as learning itself. Some would take it as far back as Socrates and Plato, or even Prometheus and Epimetheus as proponents of each (Swiboda 2012). In the 1990s voices in academia were calling for higher learning to make a complete shift from what was termed "traditional" objectivist learning approaches to a constructivist paradigm (Brooks 1999; Cobb 1994; Cooper 1993; Fosnot 1995; Jonassen 1991). The common perception was that constructivist and objectivist learning approaches were polar opposites because the philosophies behind them were so completely different (Bahari 2012; Hyslop-Margison and Strobel 2007; Jonassen 1991; Khan and Nawaz 2010; Patel et al. 2011; Vrasidas, 2000). However, some practitioners questioned whether one had to exclusively embrace one or the other (Ertmer and Newby 2013; Rieber 1992; Shabo 1997; Trollip and Alessi 2001).

In practical terms the Four-Component Instructional Design (4C/ID) model (Maggio et al. 2015; Van Merriënboer et al. 2002; van Merriënboer 2012) contains clear instances of direct instruction as well as constructivist elements. The model consists of learning tasks, supportive information, procedural information and part-task practice. It could be argued that learning tasks tend to be constructivist by nature while the provision of information tends towards direct instruction. Part-task practice might be regarded as an objectivist tool such as other drill-and-practice exercises. It is evident that this Four-Component Instructional Design model does not fit into a clearly objectivist or constructivist paradigm.

Similarly, Renkl's (2014) theory of *Example-based learning* contains both objectivist and constructivist elements. Renkl combines learning from worked examples, observational learning, and analogical reasoning to develop four *overlapping* phases of instruction: (1) Principle encoding, (2) Relying on analogs, (3) Forming declarative rules and (4) Fine tuning, automation and flexibilization. These phases involve both direct instruction and knowledge construction. Furthermore, they overlap. It is clear that such learning activities cannot be plotted on a straight line between objectivism and constructivism.

It was against the backdrop of developments such as these (Cronjé 2000, 2006) proposed that the two perspectives were not diametrically opposed, but situated orthogonally. The basis of the argument was that it was possible to include both in a single learning event without the one actually distracting from the other. The re-positioning of the two perspectives at right angles led to a four-quadrant model, as can be seen in Fig. 1.

The *Immersion* Quadrant is low in elements of both direct instruction and constructive scaffolding—it amounts to being "thrown into the deep end" and accounts for learning by experience. The *Construction* Quadrant is high in constructivist elements and low in direct instruction—resonating with problem-based learning, authentic learning (Herrington et al. 2014), as well as with what Papert (1993) calls *constructionism.* The *Injection* Quadrant is high in direct instruction and low in constructivist elements, which calls to mind the medical metaphor of getting knowledge and skills through taking a pill or having it injected. This would be the domain of drill and practice and conventional tutorials. The *Integration* Quadrant is one which, by design, is high in both elements where, depending on the situation, learners are either instructed or left to discover for themselves—either simultaneously or in rapid succession. This quadrant would accommodate 4C/ID (van Merriënboer 2012) and Example-based learning (Renkl 2014).

In the original papers (Cronjé 2000, 2006) the model was shown to have been field-tested by students who developed spreadsheets containing a list of objectivist characteristics, and also a list of constructivist characteristics. Students would then analyze a few learning experiences and see the extent to which elements of each could be identified. These quantitative exercises were based on very small samples and acted as pilot studies or proof-of-concept only. They were supported by a number of equally small qualitative studies that also showed some promise.

While the model was constructed for practical considerations as illustrated above, from a theoretical perspective it resonated with Kurtz and Snowden's (2003) Cynefin framework (Fig. 2). The world of knowledge is divided into four discrete units, the *Complex*, where cause and effect only becomes coherent in retrospect and where it does not repeat; the *Known*, where cause and effect relationships are repeatable, known and predictable; the *Knowable*, where cause and effect are separated over time and space; and *Chaos* where there is no perceivable cause and effect relationship.

The *Chaos* Quadrant corresponds with the *Immersion* Quadrant which, in the first paper (Cronjé 2000) was actually called the *Chaos* Quadrant. In the *Immersion* Quadrant the aim of learning is specifically to stabilize the experiential world, and people learn from crisis management. The *Known* Quadrant mirrors the *Injection* Quadrant—the domain of direct instruction of known information. The *Complex* Quadrant parallels the *Construction* Quadrant where learners manage patterns by constructing new real—or virtual artifacts and learning afterwards about the cause and effect. Finally the *Knowable* and *Integrated* show similarity in that designed instruction allows learning to be acquired over time through analytical and reductionist thinking.

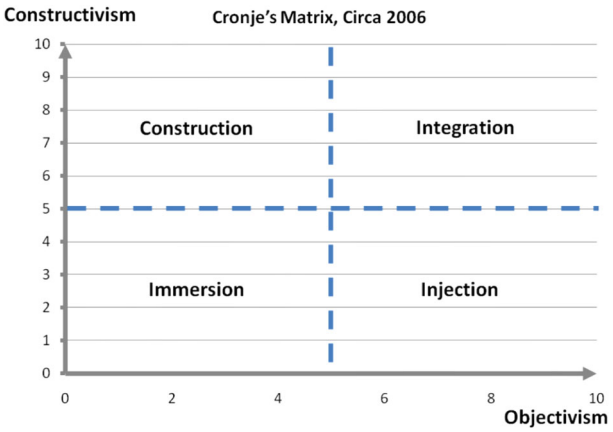

Fig. 1 The four-quadrant model(Cronje 2006)

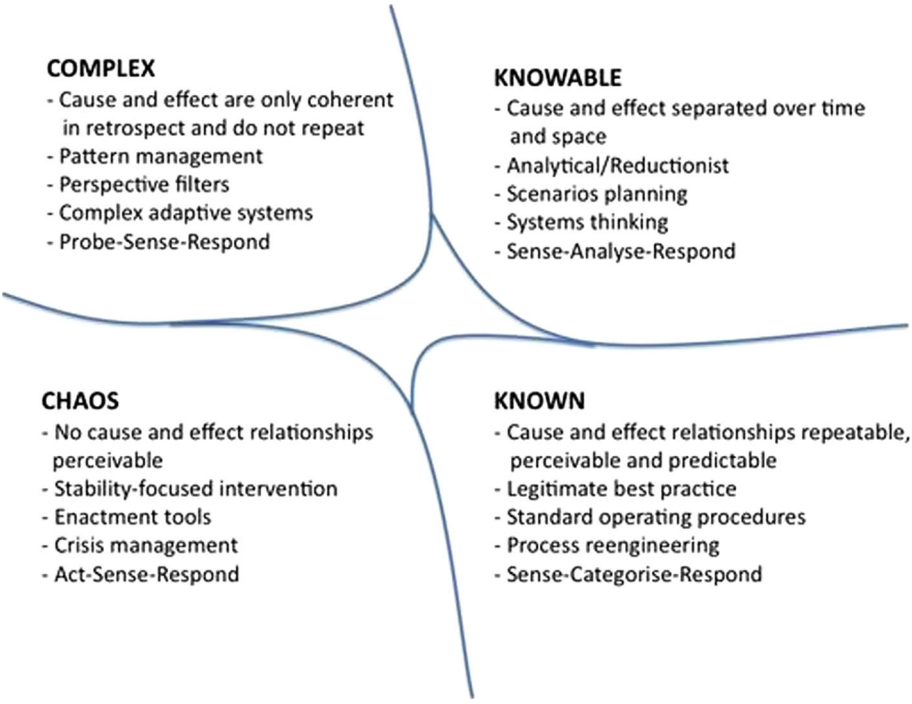

Fig. 2 The Cynefin framework (Kurtz and Snowden 2003)

On a practical level some of Cronjé's students have tested and reported on the model (Cronjé and Brittz 2005; Cronjé and Burger 2006; Kruger 2003). Independent researchers, Rainer Dangel and Hooper used it to evaluate approaches to classroom practice at a professional development school (PDS) and found that "More helpful is to consider the

approaches observed in the six classrooms using Cronjé's (2006) model. Based on this model, the teaching approach for one classroom is clearly located in the *Immersion* Quadrant (low in teaching); the teaching approach for three classrooms is in the *Integration* Quadrant (combination of instructional approaches); and the teaching approach for two classrooms fits into the *Construction* Quadrant (primarily constructivist). No teaching approaches were observed that would be categorized as *Injection* (primarily behaviorist). One advantage in using this model is that it removes the pejorative terms often used by supporters of one theory or another. This model has potential as we consider teaching approaches to make effective PDS placements for students and expand professional development for teachers in our PDS sites" (2010, p. 97).

Problem statement and research questions

The problem driving this research was to determine the extent to which current instructional design practices could be plotted on a matrix rather than on a straight line. To address this problem the research was driven by two related questions:

1. To what extent are instructional designers, course developers and instructors integrating objectivist and constructivist elements in college and university courses?
2. How many elements would be found in each of the four quadrants (immersion, construction, integration and injection)?

To answer the first question, a null hypothesis was formulated as:

H_0 The results plotted on the matrix will not significantly differ.

To answer the second question four sub-questions were formulated:

a. Will there be courses reported *integrating* objectivist and constructivist elements?
b. Will there be integrated courses reported with a more constructivist-orientation, fitting the *Construction* Quadrant?
c. Will there be integrated courses reported with a more objectivist-orientation, fitting the *Injection* Quadrant?
d. Will there be integrated courses reported where objectivist and constructivist approaches are being used equally, fitting the *Integration* Quadrant?

This study was quantitative, non-experimental and cross-sectional. The survey design asked about the frequency with which objectivist or constructivist characteristics were employed in courses developed by a stratified sample of instructional designers, course developers, and instructors who designed their own courses. The sample was drawn from 400 colleges out of the 2551 U. S. colleges and universities that issued bachelor's degrees, listed at the National Center for Educational Statistics Institute of Education Sciences (2012). The ideal sample size recommended would have been 335 schools (at a confidence level of 95 %, confidence interval of ±5) according to a standard sample size table (Johnson and Christensen 2008). Hoonakker and Carayon (2009) reported that response rates for online surveys tend to be lower than some other survey methods, with responses of 50 % or lower. The potential of a low response was mitigated by an increase of the original sample size of 335 by 20 %—partly for the anticipated 10 % for initial drop-outs, and another 10 % to compensate for an anticipated lower response rate. Based on the 20 % adjustment, the new target sample would have been 402 institutions. For

technical reasons the final adjusted sample size was 400 colleges and universities, just slightly under the desired total of 402, but still representative.

Instrument development

Literature describes multiple tools to measure constructivist elements in learning environments and in teacher styles (Aldridge et al. 2012; Fraser 1998; Maor 1999; Taylor and Maor 2000). Tools to measure the presence of objectivist characteristics or the presence of both objectivist and constructivist characteristics in the same course or lesson are virtually non-existent. During the development of the model Cronjé challenged his graduate students to create a tool to measure the presence of both objectivist and constructivist characteristics in the same learning event. The best result was Basson's (1998) spreadsheet questionnaire where participants were asked to react to a series of statements related to the presence of different aspects of learning in a course, at the same time revealing whether a particular aspect of the course was more objectivist or constructivist in character. For this research a new online survey tool was created, built upon the concepts demonstrated in Basson's (1998) questionnaire and including newer concepts from recent discussions about objectivist and constructivist approaches. Designated the Objectivist and Constructivist Integration Assessment (OCIA) instrument it summarized and referenced characteristics of objectivist and constructivist learning approaches as defined by literature, published lists, and existing inventories and tools (Anderson and Dron 2013; Baviskar l et al. 2009; Bonk and Cunningham 1998; Bruner 1966; Chen 2007; Clark 2009; Dyjur and Li 2010; Fosnot 1995; Greer et al. 1999; Jonassen 1999; Jones et al. 2010; Kang et al. 2010; Kraiger 2008; Loyens et al. 2007; Maor 1999; Taylor and Maor 2000; Wilson and Schwier 2009; Wurst et al. 2008). Rather than yes or no answers, participants were asked to rate how often various objectivist or constructivist learning elements were used in developing the course. Answers included always, to a great degree, to some degree, or never, as Frary (1996) and Heckman and Heckman (2011) recommend a four-item scale to eliminate any neutral, midpoint, or undecided answer. Survey statements came from four aspects of learning in which objectivists and constructivists typically differ: gaining knowledge, the planning and control of learning, learning dynamics, and the assessment of learning. The online survey comprised 26 statements consisting of one objectivist characteristic and one constructivist characteristic related to an aspect of the course. Initially the 13 pairs of corresponding objectivist and constructivist learning approach elements were visually arranged together. However, participants fell into the presumption that answering high on one of the pair, required answering low on the other. Later versions of the survey spaced the statements so that participants were able to respond freely to each separate statement without any preconceived limitations.

As Table 1 shows, numbers are associated with the answer choices. When participants' responses were recorded in the online survey, an objectivist score and a constructivist score was assigned for each pairing of statements. The scoring provided values needed to produce an overall objectivist score and constructivist score for the entire survey. Comparing these totals revealed whether the course was more objectivist-oriented, constructivist-oriented, or more evenly mixed. The two overall scores for the survey permitted the course to be plotted on the matrix using the two totals as vectors.

While short surveys (e.g. 10–15 min) are likely to be completed and returned (Galesic and Bosnjak 2009; Jurczyk et al. 2004) the brevity often results in the sacrifice of data

Table 1 Sample pairing statements on the OCIA online survey

Statement	0 Never	1 To some extent	2 To a great extent	3 Always
1. The instructor is perceived as the authority figure and source of information on the subject.				
Statement	0 Never	1 To Some Extent	2 To a Great Extent	3 Always
2. The instructor is a support and additional source of information among many available to the learners.				

quality. A survey of 20–30 decision items can be considered academically useful and provide better response rates than a longer survey (Jin 2011; Maronick 2009). The OCIA online survey therefore contained 26 items—short enough to increase the likelihood of receiving responses and yet useful for academic research. The academic usefulness of the OCIA was also bolstered by refinements that emerged during field testing and pilot testing of the survey questions and the entire online survey.

To ensure reliability and validity the survey statements needed to be understandable to all practitioners, even those who might not have been well acquainted with objectivist and constructivist terminology or characteristic descriptions. The first step toward achieving clarity and finalizing the OCIA survey was to have an editor and university colleagues field test the wording for clarity, conciseness, and easy-to-understand phrasing. The second step was to conduct validity and reliability testing. The survey's content underwent a validation process typical of other measurement instruments (Coughlan et al. 2009, p. 13). A field test was conducted in which the survey's content, categories, and statements were submitted to a panel of expert scholars, researchers, and instructional designers who evaluated the construct validity of objectivist and constructivist elements being measured (Gall et al. 1996). Each statement had to be determined to depict accurately the intended objectivist or constructivist characteristics. The survey was revised based on input from the expert panel, ensuring that it was deemed accurate in measuring intended objectivist and constructivist characteristics. Reliability testing involved a pre-screened group of eight university professors who design their own courses taking the online survey, then, after an average of 13 days, taking a second adapted version of the online survey. Thus two types of reliability were incorporated: Test–retest reliability and alternate form reliability (Creswell 2002; Gall et al. 1996; Ross 1978). The survey results from the two surveys were tested for reliability using Pearson correlation calculations (Gall et al. 1996; Ross 1978). If the reliability correlation was >0.60 the reliability of the tool would have been considered acceptable (Chang and Fisher 2001). The Pearson correlation for the OCIA online survey was 0.85 and therefore considered reliable.

Following the conclusion of the validity and reliability testing and ethics approval a pilot test was conducted targeting people typical of the final audience (Gall et al. 1996; Johnson and Christensen 2008). They were contacted through an email invitation process just as the participants in the main study research were. This pilot group provided an opportunity to test the email invitation process, the instructions for the survey, the survey tool performance, reactions to—and general impressions about the tool, and response/drop-out rates. Overall scores came from the sum of ordinal responses to objectivist-oriented statements and constructivist-oriented statements (the value of ordinal responses being, Never = 0, To Some Extent = 1, To a Great Extent = 2, and Always = 3). If the overall

objectivist score was more than 50 % compared to the constructivist score, and the constructivist score was more than 10 %, the course was considered an objectivist-oriented integrated course. If the overall constructivist score was more than 50 % compared to the objectivist score, and the objectivist score was more than 10 %, the course was considered a constructivist-oriented integrated course. Courses totaling more than 90 % objectivist or constructivist were not considered integrated.

Additionally, the overall objectivist and constructivist scores were also used as vectors to plot courses on the matrix. Thus, the totaled values of survey response items and frequency counts were able to answer, whether there were courses integrating objectivist and constructivist elements, as well as whether any integrated courses were strongly constructivist (in the *Construction* Quadrant), strongly objectivist (in the *Injection* Quadrant), or more of an equal integration of objectivist and constructivist approaches (in the *Integration* Quadrant). A Chi square statistical analysis was used to determine the independence of survey results and, thus, determine whether the null hypothesis in this study, H_0: *The results plotted on the matrix will not significantly differ*, was to be rejected. A second Chi square analysis was used to determine whether the survey results plotted in the four quadrants were significantly different from one another.

For the main study 205 participants responded to the anonymous online survey, and results were collected by an online survey company, *SurveyMonkey.com*. The data was retrieved in the form of an *Excel* spreadsheet. Survey results were examined using frequency counts (Rea and Parker 2012) for each objectivist or constructivist element used. The survey answers were scored and analyzed in the same way as the pilot study.

Results

The survey results were entered into an *Excel* spreadsheet designed to separately tally the objectivist score and constructivist scores for each survey. The relationship between the two scores determined the orientation of the course and whether or not it was integrated (Table 2).

Thus, the first research sub-question—*To what extent are instructional designers, course developers and instructors integrating objectivist and constructivist elements in college and university courses*?—was answered by examining the tallied objectivist scores and constructivist scores in light of the orientation criteria.

The null hypothesis was that *(T)he results plotted on the matrix will not significantly differ.* If the null hypothesis held it would mean that all the scores would align along the horizontal or vertical axes of the matrix, as is shown in Fig. 3.

Table 2 Course orientation criteria

Overall score	Score of lesser approach	Orientation
Objectivist score >50 %	Constructivist score >10 %	=Objectivist-oriented, integrated course
Constructivist score >50 %	Objectivist score >10 %	=Constructivist-oriented, integrated course
Objectivist score >90 %	Constructivist score <10 %	=Objectivist course (not integrated)
Constructivist score >90 %	Objectivist score <10 %	=Constructivist course (not integrated)

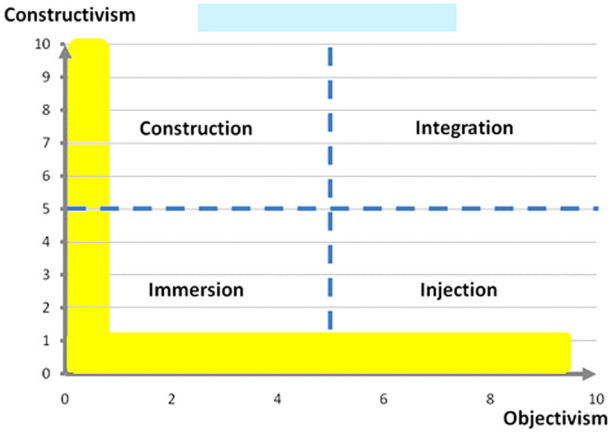

Fig. 3 Graphic illustration of the null hypothesis

Results of the pilot study

Ten US universities and colleges were invited to the pilot study and nine responded. The analysis of results in Table 1 shows that at least three of the respondents felt that their designs were high in both elements, thus belonging to the *Integration* Quadrant (Table 3).

Given the predominantly objectivist history of instructional design the majority were predictably in the *Injection* Quadrant. Nevertheless Fig. 4 shows that even in the *Injection* Quadrant there were no results against the X axis. The pilot study thus showed good initial support for rejecting the null hypothesis and moving towards a larger sample.

Results of the main study

In the main study, 400 institutions were contacted via numerous emails sent per school. 214 surveys were started. Of those, 205 completed all research data questions. Although it was not possible to track response rates in this study since it cannot be determined how many people actually received the survey email, literature indicates that response rates for online surveys can run about 50 % (Hoonakker and Carayon 2009) or even lower (Maronick 2009).

From Table 4 it can be seen that once again the majority of responses clustered in the *Injection* Quadrant, with the *Integration* Quadrant coming in second.

As is shown in Fig. 5 the results of the main study were very similar to those of the pilot study, with only two responses close to the X axis.

From the data given in Table 4 and plotted on the four quadrants in Fig. 5 it is now possible to answer the four sub-questions of question 2: *How many elements would be found in each of the four quadrants (immersion, construction, integration and injection)?*

a. Will there be courses reported *integrating* objectivist and constructivist elements? The results showed that 100 % of courses showed some degree of integration. Only two of the courses were close to being exclusively objectivist.
b. Will there be integrated courses reported with a more constructivist-orientation, fitting the *Construction* Quadrant? Thirteen responses (6.3 %) plotted in the *Construction*

Table 3 The results of the pilot study

Quadrants the matrix	Total	Percent (%)
Construction	1	11
Integration	3	33
Injection	4	44
Immersion	1	11

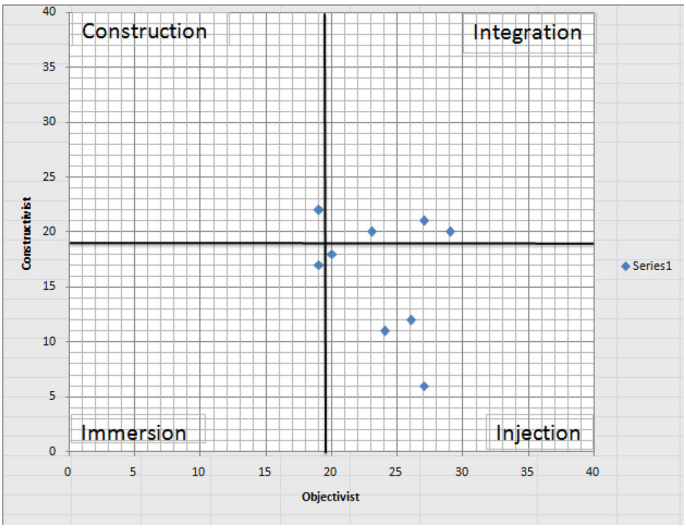

Fig. 4 Pilot study plotted in four quadrants

Table 4 The results of the main study

Quadrants of the matrix	Total	Percent (%)
Construction	13	6.3
Integration	74	36
Injection	110	53.8
Immersion	8	3.8

Quadrant. However, if one looks beyond the *Construction* Quadrant to general constructivist orientation and include *Integration* Quadrant courses, there are 87 courses (42.3 %) that scored above the mid-point on the constructivist axis, and none of the courses containing constructivist elements scored at or below 10 % on the objectivist axis.

c. Will there be integrated courses reported with a more objectivist-orientation, fitting the *Injection* Quadrant? There were 111 courses (53.8 %) located in the *Injection* Quadrant. Additionally, if the question were broadened to objectivist orientation in general the total including the *Integration* Quadrant courses was 185 courses (89.8 %) that scored above the mid-point on the objectivist axis, and none of the courses containing constructivist elements scored on or below 10 % on the objectivist axis.

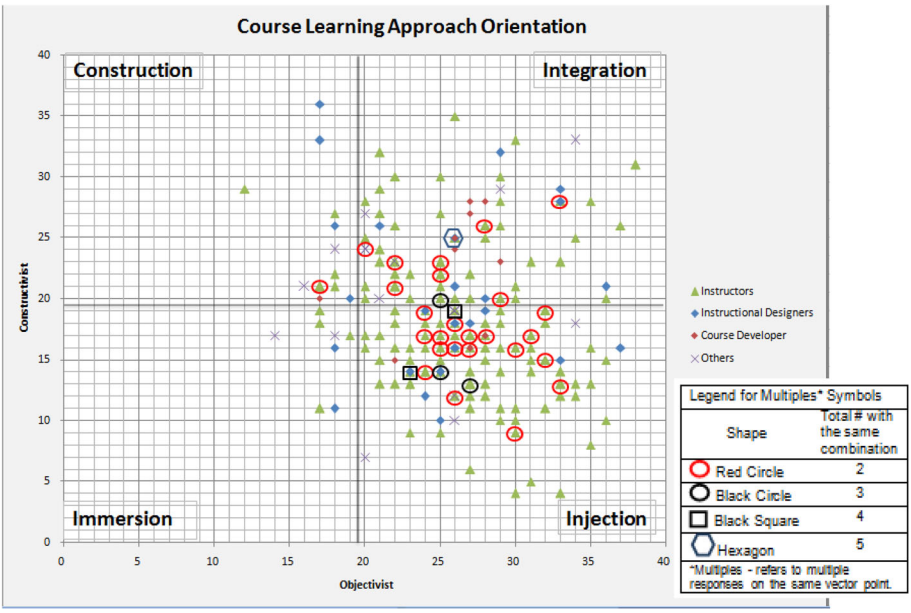

Fig. 5 Main study plotted in four quadrants

d. Will there be integrated courses reported where objectivist and constructivist approaches are being used equally, fitting the *Integration* Quadrant? Seventy-four courses (36 %) were in the *Integration* Quadrant.

Null hypothesis

The null hypotheses in this study related to the research questions was: H_0: *The results plotted on the matrix will not significantly differ*. To test this hypothesis the results of the survey distributed across the four quadrants of the matrix were entered into a one-way Chi square test of independence to determine if there was a significant difference between the results reported in the four quadrants. The results of the Chi square test of independence (see Table 5) revealed that the null hypothesis was rejected with the results not likely to be caused by chance.

A follow-up Chi square analysis examined whether the results of the *Integration* Quadrant were significant in relation to the other quadrants. The results of this follow-up analysis (Table 6) indicated that there was a significant difference in each match-up of quadrant results, except between the Construction Quadrant and the *Immersion* Quadrant.

The *Construction* Quadrant and the *Immersion* Quadrant had the fewest number of responses of the four quadrants. It is possible that there is a significant difference between these quadrants; however there were not sufficient results to statistically indicate this. The fact that the *Immersion* Quadrant, being low in both objectivist and constructivist elements, is more compatible with settings such as self-study, informal, or incidental (Cronje 2006) learning may have effected its representation in a higher

Table 5 Chi square test of independence for the plotted data

	Observed N	Expected N	Residual
Quadrant			
Construction	13	51.3	−38.3
Integration	74	51.3	22.8
Injection	110	51.3	58.8
Immersion	8	51.3	−43.3
Total	205		
Test statistics			
Quadrant			
Chi Square			142.493[a]
Df			3
Asymp. Sig.			0.000

[a] 0 cells (0.0 %) have expected frequencies <5. The minimum expected cell frequency is 51.3

Table 6 Chi square test of significance for the pairings of the four quadrants

Quadrant difference match-ups	Observed	Expected	O–E	$(O–E)^2$	$(O–E)^2/E$	
Construction	13	43.5	−30.5	930.25	21.38505747	
Integration	74	43.5	30.5	930.25	21.38505747	
	87	87			42.77011494	χ^2
					0.00000	ρ
Construction	13	61.5	−48.5	2352.25	38.24796748	
Injection	110	61.5	48.5	2352.25	38.24796748	
	123	123			76.49593496	χ^2
					0.00000	ρ
Construction	13	10.5	2.5	6.25	0.595238095	
Immersion	8	10.5	−2.5	6.25	0.595238095	
	21	21			1.19047619	χ^2
					0.27523	ρ
Integration	74	92	−18	324	3.52173913	
Injection	110	92	18	324	3.52173913	
	184	184			7.043478261	χ^2
					0.00796	ρ
Integration	74	41	33	1089	26.56097561	
Immersion	8	41	−33	1089	26.56097561	
	82	82			53.12195122	χ^2
					0.00000	ρ
Injection	110	59	51	2601	44.08474576	
Immersion	8	59	−51	2601	44.08474576	
	118	118			88.16949153	χ^2
					0.00000	ρ

Note. Significance: $p < .05$

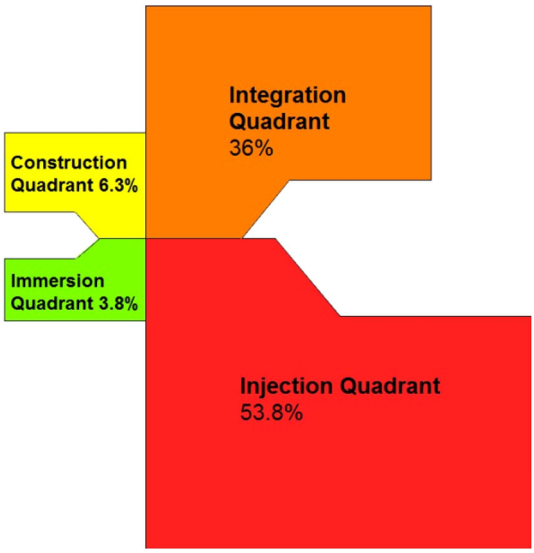

Fig. 6 Graphic representation of the distribution into four quadrants

learning setting. A larger sample or a sample in another industry may have produced different results for this pairing.

Conclusions

The first question of this study asked whether, from the sample, one would be able to identify courses whose instructional designers, course developers and instructors were integrating objectivist and constructivist elements in their designs. This was supported by the data, showing that 100 % of courses evaluated in the main study and 100 % of courses in the pilot study showed instances of the integration of the two paradigms. The results, graphically represented in Fig. 6, showed that there were indeed courses in each of the four combinations represented by quadrants in the matrix, as was asked by question two. The Construction Quadrant, with a constructivist orientation, contained 6.3 % of the main study results (11 % in the pilot results). The *Integration* Quadrant, with high levels of both objectivist and constructivist elements, contained 36 % of the main study results (33 % in the pilot). The *Injection* Quadrant, which has an objectivist orientation, contained 53.8 % of the main study results (44 % in the pilot). The *Immersion* Quadrant, with low levels of objectivist and constructivist elements, contained 3.8 % of the main study results (11 % in the pilot). The placement of courses in the four quadrants resonates with Rainer Dangel and Hooper's qualitative study at a PDS, except that in their study the *Injection* Quadrant was the smallest. Given the current move in teacher professional development away from the objectivist approach this is understandable. Nevertheless, the two studies together provide strong support for the model.

There are two ways in which the results speak against long-held assumptions about objectivist and constructivist learning approaches being opposite poles on a continuum. Firstly it showed evidence of 214 (Pilot = 9, Main study = 205) courses doing what should be impossible—integrating both objectivist and constructivist learning approaches.

In contrast to many articles that had declared that objectivist and constructivist learning approaches cannot be combined (Bahari 2012; Jonassen 1991; Khan and Nawaz 2010; Patel et al. 2011; Vrasidas 2000) in the field of higher education, instructional designers, course developers, and instructors created courses that could be classified as integrated.

If the bipolar relationship was the ruling principle then course designers would have chosen one approach over another, and plotted responses would have clustered along the objectivist or constructivist axes (see Fig. 3).

Recommendations for further research

The current study showed support for the model in describing the nature of learning events in a higher-education instructional design context. It resonated with a qualitative study in secondary education. What was encouraging was that the "footprint" of the two studies differed in terms of the spread across the quadrants. More research could follow to review the manner in which various educational and training sectors design their interventions.

Research is required that would lead to our understanding of the aspects that designers consider when they decide on particular elements of their courses. In other words, what are the aspects to consider in deciding when a learning event should fall into the *Instruction, Construction, Immersion* or *Integration* Quadrant?

Compliance with ethical standards

Conflict of interest This study was self-funded and no conflict of interest exists.

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