Paradigms Regained: Toward Integrating Objectivism and Constructivism in Instructional Design and the Learning Sciences

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This article proposes a model that integrates the traditionally conflicting objectivist and constructivist approaches to instructional design. I argue that these two approaches are complementary rather than oppositional. I present and analyze two learning programs in order to show how learning events can contain both objectivist and constructivist elements. By plotting the two approaches at right angles to one another, I produce four quadrants which I then discuss and explain. What follows after that is a discussion of comments that were received from members of a prominent instructional technology mailing list about the feasibility of the model. Finally I present two case studies. The first describes a two-day workshop that was designed to be high on both axes, while the second shows how the model could be used as a decision-making tool. Initial findings suggest that it is both feasible and useful to plot objectivism and constructivism at right angles to one another rather than at opposite ends of a continuum.

Keywords: Constructivism, objectivism, instructional design, learning sciences, integration, e-learning

There has been considerable debate over the past few years about the traditional practice of labeling approaches to learning as either objectivist or constructivist. The implication of this is that the two terms are exclusive and that the pendulum of fashion or emphasis swings periodically from the one extreme to the other. Practitioners will then support either one approach or the other, or else they may advocate taking a middle path (Cook, 1993; Lebow, 1993; Philips, 1995; Von Glasersfeld, 1996).

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The perception remains that the two approaches can be plotted at opposite ends of a straight line. "The two theories are generally described as polar extremes on a continuum from externally mediated reality (objectivism) to internally mediated reality (constructivism)" (Jonassen 1991, p. 8). If one accepts such a model, then one must characterize any given learning event as either objectivist or constructivist, or else locate it somewhere on the continuum between the two extremes. Unavoidably, though, the closer one places the learning event to one extreme, the more one diminishes it in terms of the other (Figure 1).

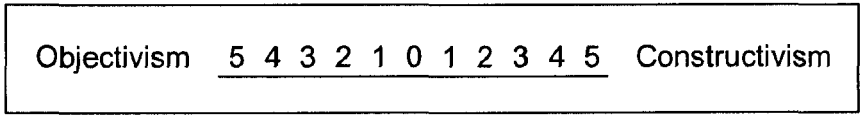
Not only are these poles viewed as existing on either side of a continuum, (Vrasidas 2000), but (it is argued) they cannot be mixed or integrated. "Constructivism is completely incompatible with objectivism" (Bednar, Cunningham, Duffy & Perry, 1992, p. 91). Thus, an instructional designer is required to be either constructivist or objectivist. To be otherwise is untenable because the philosophical assumptions underlying both positions contradict one another. Or so current dogma asserts.

Several problems arise from the use of this categorization. One is that it cannot accommodate learning situations that clearly contain elements of both approaches. In terms of this definition, anyone who supports one extreme must necessarily shun the other because of the negative light in which the other side is portrayed. The usual criticism of the other side is that it is incapable of delivering good teaching.

Brooks pointed out that "constructivism describes an internal psychological process" (1990, p. 68), rather than a set of teaching practices. Placing the two upon the same continuum means committing a *category mistake*—the mixing of logically incompatible elements.

The objectivist-constructivist debate is related to the division between instructional design (ID) and learning sciences (LS) in the United States. It is extensively expressed in the May-June 2004 issue of *Educational Technology* as articulated by Merrill (2004), Ragan and Smith (2004) Reigeluth (2004) and Spector (2004). Spector's comments revealed the relationship between the objectivist-constructivist debate and the ID-LS debate: "One might argue that with regard to learning outcomes, LS is primarily focused on learners and

Figure 1 □ Objectivism opposite to constructivism.



basic questions about learning, while ID is primarily focused on learning and basic questions about instruction" (p. 48). Some of the observations and questions posed by the authors named above are material to the arguments presented in this article. This article itself is my South African response to the question posed by Spector (2004, p. 48): "Where are the African, Asian, European, Pacific Islander, and South American voices in this dialogue?"

This article proposes a matrix model that integrates the two dimensions.

BACKGROUND

Molenda (1997) identified the starting point of the debate as Jonassen's challenge to the instructional design and technology community to "question the 'objectivist epistemology' underlying practice in the field" (1991, p. 46).

The conflict, I believe, has been unnecessarily intensified and prolonged because both dimensions have been rather poorly defined. Alessi and Trollip (2001 p. 37) spoke of *objectivism* as a term "often used by constructivist educators to define what they consider the opposite end of the continuum of themselves." I will use the term *objectivism* in the sense that it emerges in Jonassen's (1991) challenge.

Unfortunately, definitions of *constructivism* are equally vague. In his commentary on constructivst didactics, Terhart (2003) noted the extent of the confusion:

> The main problem with any more precise analysis of these 'foundations' is the fact that the central concept—construction/constructivism—is used in a very unhomogeneous and inconsistent way. At the one end of the spectrum, we have radical constructivism. In the middle area, we have a moderate and/or trivial constructivism, and at the opposite end some kind of pseudoconstructivism. The last position still sticks to traditional instructivism but masks this with a constructivist jargon. So on the level of theory (i.e., reflection) we do not see a new paradigm. What we see instead is a fuzzy combination of different lines of thought only held together by the fact that they all, in a way, include 'construction' or 'constructivism' as concepts. (p. 41)

For the sake of consistency, I will use Jonassen's exposition of *constructivist* beliefs: "Radical constructivists believe that there is no real world, no objective reality that is independent of human mental activity" (1991, p. 10). I adopt this definition in full awareness that Jonassen provided a more nuanced definition of his position when he wrote: "Perhaps the most common misconception of

constructivism is the inference that we each therefore construct a unique reality, that reality is only in the mind of the knower" (1994, p. 35).

The most obvious deficiency of the continuum model, as I shall try to demonstrate, lies precisely in the tendency of positions located on the continuum to drift toward the center. Terhart (2003) noted that although these opposing "world-views are distinctly different, . . . they have one important characteristic in common: they can be formulated and advocated with different degrees of radicalness" (p. 31). I will now revisit how instructional designers tend to think about the polarities of the continuum by focusing on Jonassen's 1991 exposition.

In order to recapitulate the ground for the discussion that follows, I have synthesized some of the assumptions inherent in objectivism and constructivism that Jonassen (1991, p. 9) and others have presented in different places (see Table 1).

Table 1 ☐ Contrasting views of objectivism and constructivism.

Category	*Objectivism*	*Constructivism*
The real world . . .	has entities that can be categorized on the basis of their properties and relations.	is structured by our individual minds on the basis of our interactions (this limits what we can know about the real world).
Reality is . . .	fully and explicitly structured in a way that is shared by all who perceive it. Because of this commonality, reality can be modeled and shared with others.	local (personal) to ourselves in a universe of multiple realities. Our realities are modeled by the way in which we personally construct them.
Symbols are . . .	representations of reality, and are only meaningful to the degree that they correspond to reality.	products of culture that are used to construct reality.
The human mind . . .	processes abstract symbols and fashions them so that they mirror nature.	perceives and interprets the world by creating symbols.
Human thought is . . .	symbol-manipulation and is independent of the human organism..	is imaginative, and develops out of perception, sensory experiences, and social interaction.
Meaning . . .	exists objectively and independently of the human mind—and is external to the knower.	is a construction that is the end result of an interpretive process that depends on the experience and understanding of the knower.

(Compiled from Cobb, 1994; Jonassen, 1991; Lakoff, 1987; Philips, 1995; Vrasidas, 2000.)

Reeves (1994) and Reeves and Harmon (1994) provided an extensive breakdown of the characteristics of each extreme, and proposed a useful basis for evaluating interactive multimedia by plotting each of the dimensions on a scale and thus obtaining a profile of any multimedia program. The dimensions they described are synthesized in Table 2.

Although Reeves and Harmon's (1994) two sets of extremes are mutually exclusive opposites, this does not imply any judgment about one being correct or the other incorrect. And although Reigeluth (1996) also provided a useful table of characteristics that reside on opposite extremes (see Table 3), an industrial age paradigm is, by implication, dated and therefore of less value.

The South African National Department of Education (South Africa, 1997a, 1997b) has also taken up a judgmental stance against one paradigm. This is shown in Table 4.

Whereas Rieber (1992) proposed "microworlds" as a bridge between the two extremes, Alessi and Trollip (2001, p.38) thought that the "current world of educational theories is really a triangle, with behaviorism, cognitivism and

Table 2 ☐ Pedagogical dimensions (synthesized from Reeves, 1994; Reeves & Harmon, 1994).

Category	*Extremes on the continuum*	
Epistemology	Objectivism	Constructivism
Pedagogical philosophy	Instructivist	Constructivist
Underlying psychology	Behavioral	Cognitivist
Instructional sequencing	Reductionist	Constructivist
Goal orientation	Sharply focused	Unfocused
Role of teacher-instructor	Authoritarian-Didactic	Egalitarian-Facilitative
Experiential value	Abstract	Concrete
Program flexibility	Teacher-proof	Easily modifiable
Value of errors	Errorless learning	Learning from experience
Motivation	Extrinsic	Intrinsic
Structure	High	Low
Learner control	Nonexistent	Unrestricted
User-activity	Mathemagenic	Generative
Accommodation of individual differences	Nonexistent	Multifaceted
Cooperative learning	Unsupported	Integral
Cultural sensitivity	Nonexistent	Integral

Table 3 ☐ Shift from an industrial age to an information age (Reigeluth, 1996).

Industrial Age	*Information Age*
Standardization	Customization
Centralized control	Autonomy with accountability
Adversarial relationships	Cooperative relationships
Autocratic decision making	Shared decision making
Compliance	Initiative
Conformity	Diversity
One-way communications	Networking
Compartmentalize	Holism
Parts-oriented	Process-oriented
Teacher as "king"	Learner (customer) as "king"

Table 4 ☐ Shift in government focus (South Africa, 1997a: 29; 1997b: 6–7).

Old	*New*
Passive learners	Active learners
Examination-driven	Learners are assessed on an on-going basis
Rote-learning	Critical thinking, reasoning, reflection and action
Syllabus is content-based and broken down into subjects	An integration of knowledge; learning relevant and connected to real-life situations
Sees syllabus as rigid and nonnegotiable	Learning programs seen as guides that allow teachers to be innovative and creative in designing programs
Emphasis on what the teacher hopes to achieve	Emphasis on outcomes—what learner becomes and understands
Behavioral approach to learning and assessment	Cognitive approach to learning and assessment
Assessment of isolated knowledge or discrete skills	Knowledge, abilities, thinking processes, metacognition and affect assessed
Individual learning and products	Collaborative learning and products

constructivism at the vertices. Most educators are somewhere in the *middle* of that triangle." In spite of this, I accept the model of binary opposition as my point of departure. Alessi and Trollip (p.38) made the following insightful comment about the binary approach: "Perhaps the reason that constructivists

wish to combine cognitivism and behaviorism into a single entity (called either *objectivism* or *instructivism*) is that people always feel comfortable with a two-ended continuum." In this article, I do not question *why* people feel more comfortable with a binary approach. I simply accept that they do. The thrust of my argument is that a continuum of this kind is of limited utility because it does not make allowance for the complexities inherent in what is being described. Inevitably therefore, instructional designers will always find themselves "somewhere in the *middle*" (Alessi & Trollip, p.38) unless they somehow move beyond the limitations imposed by the binary model.

THE PROBLEM

Before proceeding, it will be useful to refine what is meant by this middle—particularly because the more people occupy the middle ground, the more they draw from both extremes. Although Vrasidas (2000), for example, avoided the extremes, he noted "that there are times that a more objectivist approach is appropriate and there are other times that a more constructivist is appropriate" (p. 359). My question, therefore, is:

> What kind of model might permit us to integrate objectivism and constructivism into a complementary and harmonious whole?

The main benefit of such a model is that it would allow practitioners to draw freely from both extremes without being accused of having taken up a philosophically untenable position. The resultant integrative model could then be used to guide a more realistic selection of appropriate teaching and learning strategies. A corollary to this question is:

> Can it be shown that some learning events are high in *both* objectivist and constructivist characteristics?

If this proposition can be shown to be true, it would follow that the two polar extremes are *not* opposites, but can be reconceptualized so that high levels of *both* characteristics can be harmoniously accommodated in one model.

At this point it becomes necessary to define a *learning event,* not as a single iteration of stimulus-response-reinforcement, but rather as a series of interventions that are designed to reach a specified objective. In other words, many different elements need to be combined to form a single piece of designed instruction, or a learning event. I use *learning event* as an umbrella term that may include a lesson, a lecture, a computer program—or even any real-life experience from which a person can learn something. I also use this term so that I can avoid using the word *instruction,* which (for various reasons) tends

to have negative connotations in South Africa. I believe that it is in the design of a learning event that objectivists and constructivists, as well as learning theory and ID, can move toward integration.

TOWARD INTEGRATION

The two approaches, objectivism and constructivism, have different goals: Objectivists tend to concentrate on direct instruction whereas constructivists focus on learning (Brooks, 1990). But the reason for the tendency of practitioners to move toward the middle of the continuum may be the instinctive realization that the process of learning requires substantial cognitive processing (Wittrock, 1989). My personal position is that this so-called middle of the continuum is a "false mid-point" (Thouless 1974). If it were truly a middle point, then it follows that anyone operating in that position would use very little from either side. Yet Mayer (2001) argued that, regardless of the medium or method used, learning involves three processes: (a) selecting, (b) organizing, and (c) integrating, whereas Mayer and Moreno (2002) argued that an "important challenge of multimedia learning concerns whether it is possible to promote constructivist learning from passive media" (p. 110). It could be argued that selecting and passive media belong to the objectivist side, that integrating belongs to the middle, and that organizing belongs to the constructivist side. However, as Meyer (2003) and Mayer and Moreno (2003) implied, learning depends on intensive use of elements from both sides of the continuum, and not on the extent to which one has been successful in claiming occupation of some gray and neutral middle ground.

Smith and Ragan's (1999) model of cognitive load and information processing indicates that elements from *both* sides are important because education comprises both generative and supplantive elements. They demonstrated how Gagné's events of instruction can act as the central core for both points of departure, as Table 5 shows.

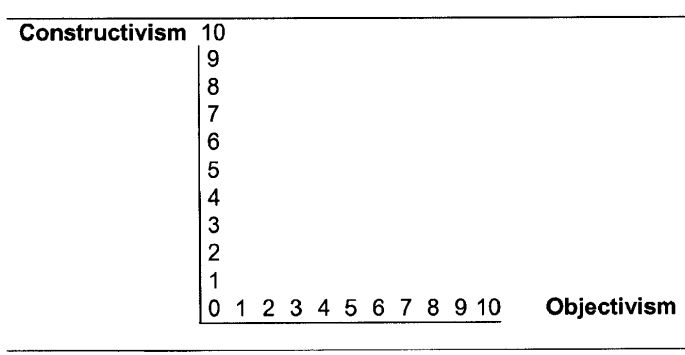
Because, as Vrasidas (2000, p. 357) pointed out, "dominant paradigms, in both the physical and social sciences, rarely replace each other by falsification," instructional designers might have more success in resolving the current polarities dilemma if they could in some way place them at right angles to one another. The advantage of such a model is that while it could still show how the two polar extremes relate to one another, that relationship would not be mutually destructive or inimical (see Figure 2).

The use of a right-angled model allows a learning event to be characterized as both highly constructivist and highly objectivist without any inherent contradiction.

Table 5 ☐ Supplantive and generative instructional events (adapted from Smith & Ragan, 1999).

Supplantive	*Generative*
Introduction	
1. Compel attention to lesson	Activate attention to lesson
2. Inform learner of instructional purpose	Establish purpose
3. Stimulate learner's attention and motivation	Arouse interest and motivation
4. Provide overview	Preview learning activity
Body	
5. Stimulate recall of prior knowledge	Recall relevant prior knowledge
6. Present information and examples	Process information and examples
7. Compel and direct attention	Focus attention
8. Guide or prompt use of learning strategies	Employ learning strategies
9. Provide for and guide practice	Practice
10. Provide feedback	Evaluate feedback
Conclusion	
11. Provide summary and review	Summarize and review
12. Enhance transfer	Transfer learning
13. Provide re-motivation and closure	Re-motivate and close
Assessment	
14. Conduct assessment	Assess learning
15. Provide feedback and remediation	Evaluate feedback

Figure 2 ☐ Objectivism complementary to constructivism.



Once the two axes have been plotted against one another, four quadrants with varying degrees of integration emerge. As Figure 3 shows, I have named the quadrants Injection, Construction, Integration, and Immersion.

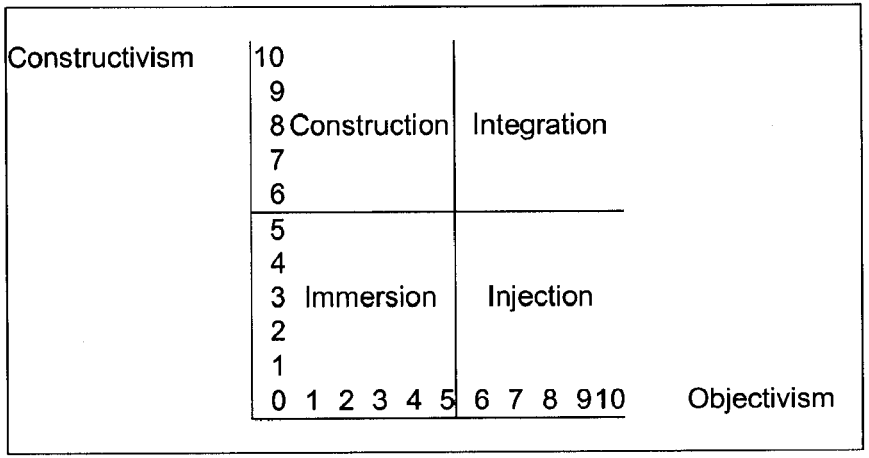
I shall now show how learning can take place in each of the quadrants.

Injection

What I have named the quadrant of Injection is high in objectivist elements. It emphasizes the notion that preproduced knowledge, skills and/or attitudes are transferred into the learner in as an efficient, predetermined and predigested way as possible. Like medical injections, the intervention is validated and standardized. It is the domain of learning programs, tutorials, lectures, and "drill and practice." The principal rationales of injection are "automaticity" (Bloom, 1986), efficiency, and focus. It inspires the direct instruction that is so descriptive of industrial and military pedagogy. Such approaches are not to be despised. They can be lean, mean—and efficient—in their own domains.

This quadrant could accommodate those of whom Reigeluth (2004, p. 55) wrote: "In essence, I agree that *some* instructional scientists (those who have a knowledge consumer focus) view the design as an end in itself for that is the nature of the work they want to pursue."

Figure 3 □ Four quadrants of teaching and learning.



Construction

Construction is designed in such a way that learners intrinsically construct their own meaning by building on their previous knowledge and experience. Its principal outcome is an individual understanding. Its principal advantages are effectiveness and transfer. This quadrant is typically the domain of teachers supporting the new paradigm. It is certainly in this quadrant that one would place Papert's *constructionism,* which is "built on the assumption that children will do best by finding ('fishing') for themselves the specific knowledge they need" (1993, p. 139). Although the greatest advantage of this quadrant is probably the depth of understanding that can sometimes be achieved, its disadvantage is that it can consume inordinate amounts of time.

Immersion

Learning by immersion is low both in objectivist and constructivist elements. In the early stages of developing this model, I called this quadrant the "chaos" quadrant (Cronjé, 2000). Learning is not determined by an outside entity, nor is it placed in any given, predetermined sequence. Learning experiences are opportunistic. There is no clear evidence of a conscious effort to facilitate an opportunity for the learner to construct meaning.

It would seem that no learning could take place in such situations. Yet, consider the following anecdotes. A driver changes lanes without checking the rear-view mirror or signaling. The driver in the lane alongside honks, flashes his lights, and curses vociferously. Thereafter, the first will probably never forget to look and signal. In the second example, a toddler picks up a little, striped, black and yellow bug. The bug stings the child painfully, who, thereafter, avoids such bugs.

In both examples, learning has clearly taken place. But there has been no planning, and no formal or even informal instructor has been present—no overt objectivism. Neither has there been any conscious effort on anyone's part to facilitate such learning—no overt constructivism. The Immersion quadrant is the domain of serendipitous learning. It may well be that most learning takes place in this way. It accounts for experience rather than studying or training, and corresponds in one respect with what is traditionally written about incidental learning or being thrown in at the deep end.

It is in this quadrant that the question asked by Merrill might find an answer:

> How does the individual learner, enrolled in asynchronous, at-a-distance e-learning, who is learning from contrived

> materials that may not meet the definition of learning environment, learn? (2004, p. 46)

Integration

Integration is the combination of instruction and construction in appropriate conditions. Essentially this is the domain of the instructional designer. Merrill encapsulated this quadrant's purpose as follows: "Just as there are different components of knowledge, presentation, and learner guidance appropriate for different kinds of instructional goals, so there are different kinds of practice appropriate for different instructional goals" (2002, p. 51).

Learning in this quadrant requires goal analysis so that essential learning outcome can be determined. Thereafter, analyses to determine the skills and subskills required for the learning outcome to be achieved, and the development of instructional objectives, would follow. The designer would then select elements from both the objectivist and constructivist domains to achieve the envisioned outcome. Evaluation of learning would range from decontextualized testing of rote learning through authentic testing to portfolio assessment—depending on the performance criteria that had been specified during the prior processes of goal analysis and objective setting.

I suggest that Smith and Ragan's (1999) three-part model of ID fits neatly into this quadrant. Their model suggests an analysis phase that is concerned with learning contexts, learners, and learning tasks, followed by a strategy phase that involves organizational, delivery, and management strategies, and, finally,an evaluation phase that deals with formative evaluation and revision. A user of the model would select both generative and supplantive elements as and when they became necessary. It is in the Integration quadrant that I believe instructional designers function. Spector (2004) noted: "ID researchers are more likely to be familiar with a variety of learning theories and performance technologies and typically approach problems in an academically interdisciplinary nature" (p. 47). It is in this quadrant, certainly, that *both* questions suggested by Ragan and Smith (2004, p. 52) would be asked:

> Under what conditions would a discovery approach be helpful?
>
> In what situation might an expository approach be needed?

Integration becomes the quadrant in which both the ID and LS communities come together in their conduct of of design-based research, which "offers specific guidelines for developing a new design theory" (Reigeluth 2004, p. 55–56).

METHOD

I first tested the feasibility of the model in a pilot study in 1998. I followed this with a discussion on a dedicated mailing list (in 2000), and two case studies (in 2003).

The Pilot Study

The model referred to above was discussed in a class of master's in computer-integrated education candidates at the University of Pretoria, South Africa. As part of the pilot study, students were asked to construct and test spreadsheets that would reflect and measure the extent to which a particular learning opportunity filled a particular quadrant. They were required to assess two programs that showed different approaches to teaching the same subject matter. The master's class adjudged the spreadsheet created by Basson (1998) to be the most precise instrument. The results will be discussed below. Basson's spreadsheet may be viewed at:

http://hagar.up.ac.za/catts/learner/bettieb/98lro880/principles.xls.

The Mailing List Discussion

The results of Basson's (1998) spreadsheet, and a description of her model were presented in an occasional paper (Cronjé, 2000) to the ITForum discussion list (ITForum, s.a.). At the time of the research, the list had approximately 1,500 members. The list operated as follows: Someone was invited to post a paper to the list Web site. Members of the list would then discuss the paper with its author and one another for a period of one week. During the discussion reported here, I issued the following challenge to members of the list:

> I need to ask you to answer two questions. They are:
>
> a. Do you think that it is feasible to plot objectivism and constructivism at right angles to one another—rather than at 180 degrees?
>
> b. Can you think of a program or lesson or learning event that would score high on both counts?
>
> If your answer is "yes" in both cases, why not download Bettie's spreadsheet? Run some programs through it, and let us have your results (Cronjé, 2000).

Two Case Studies

After some process of refining the model, a new group of master's students was asked to design, present, and evaluate learning events that would be high on both axes, and then to run their results through Basson's (1998) spreadsheet. One such event, a two-day workshop, is reported here.

In an unrelated module, master's students were asked to analyze the use of computers in schools and to make recommendations for improvement. One student (Kruger, 2003) found that the model was a useful tool for decision making when determining the purpose of a new computer laboratory.

FINDINGS

My integrative matrix model is based on these two assumptions:

1. One axis is not "better" than the other axis. The two are just different. They are means to different ends.
2. Any learning event, be it a lecture, workshop, case study, or drill, may draw from both axes, if not simultaneously, then sometimes in such rapid succession that it seems as though they are acting simultaneously.

The first assumption is derived from the pendulum effect mentioned in the introduction. Throughout the ages, educational thinkers have supported either the one side or the other. Both sides could not always have been wrong.

The second assumption is implied by the first because, if the two axes have different points of departure, they cannot coexist and still be plotted on the same straight line.

Results of the Pilot Study

In order to test the workability of the model a group of students reading toward the University of Pretoria's Master's Degree in Computer-Assisted Education was given the task of designing a spreadsheet that would measure the extent to which any given learning experience had been designed according to objectivist or constructivist principles. (The task would fall into the Construction quadrant of Figure 3 because students were expected to construct both their own understanding as well as the analysis tool.) The students were asked to find descriptive references to constructivism and objectivism. They then had to extract the principal characteristics of both from their data and then frame these in the form of yes-no questions. Then they had to work out

how to set up a Microsoft Excel® spreadsheet with relevant macros that would produce the required graph.

The second phase of the task was to evaluate two programs by using the spreadsheet. The first program was called Statistics for the Terrified and the other was called Active Stats. (These two programs were selected because, when used in combination, they tested whether candidates were able to apply the statistical knowledge that the research methodology course required for that part of the master's degree program. Statistics for the Terrified follows an emphatically linear path through the learning material, while Active Stats appears in the form of a worksheet which students can use to conduct their own experiments and draw conclusions from the results. The promising results achieved by Basson's (1998) spreadsheet are shown in Table 6.

Table 6 □ Basson's (1998) *Analysis of Active Stats* and *Statistics for the Terrified.*

	Active stats	*Statistics for the terrified*
Objectivist	3,8	7,7
Constructivist	6,2	3,1

Basson's analysis places Statistics for the Terrified in the quadrant of Injection and Active Stats in the quadrant of Construction. It seems that the answer to the question, How can objectivism and constructivism be integrated into a complementary whole? is, Possibly by means of a matrix. The matrix permits to identifying and acknowledging objectivist characteristics without negating constructivist characteristics, and vice versa.

But a problem remains when looking for an answer to the corollary question, Can it be shown that some learning events are high in both objectivist and constructivist characteristics? It seems that the answer here is, Not quite.

Although the analysis showed that Active Stats is high in constructivist characteristics, and Statistics for the Terrified is high in objectivist characteristics, neither program was found to be high in both.

There are three possible explanations for this. Firstly, the programs selected for evaluation may simply happen to belong in opposite quadrants of the matrix, and, secondly, only five evaluations were conducted, just one of which has been reported here. A third possible explanation is that the spreadsheet itself may need refinement.

Nevertheless, what the analysis demonstrated quite clearly is that both programs contained elements of both objectivism and constructivism.

Summary of the Mailing List Discussion

When a seminal version of this model was posted on the Internet-based discussion list ITForum (Cronjé, 2000) a number of valuable comments were raised. Some of these are dealt with in the following three sections. The first covers general comments, while the second and third deal with list members' answers to the two questions that were put to the list, as mentioned in the Method section.

General comments

Comments by Sawyer (2000) and Marsh (2000) about the social nature of learning and the role of support in learning led to rethinking some aspects of the Immersion quadrant (which, at that time, I was still calling the chaos quadrant). (Although the discussion focused on the nature of feedback and social aspects of learning, I will not report those exchanges here because they are not crucial for following my main argument.)

Pelton (2000) commented as follows on the "value judgments" that he detected in the comparison tables:

> It is interesting to look at the comparison tables provided, and note that some pejorative terms are used to describe the "old" methods. We often see authors exaggerating the importance of their favorite position while denigrating and distorting earlier ideas in an effort to amplify their points.

In reply to this (valid) observation, I should like to point out that we specifically selected the tables in question to show how the objectivist-constructivist dichotomy has been emotionalized in the past. However, an underlying basic assumption of this article is that one axis is neither better nor worse (in any way) than any other.

Marsh (2000) pointed out that whereas objectivists emphasized classroom practice, "constructivist theory is increasingly influential in educational theory, but the extent to which it may also influence actual classroom practice is problematic. The reason is that 'constructivism describes an internal psychological process,' not a set of teaching practices" (Brooks, 1990, p. 68).

Here Marsh identified the fundamental illogicality of the objectivist-constructivist debate. One side designs instruction. The other side tries to understand how we learn. Because both sides are engaged in understanding and practicing two different areas of scholarly endeavor, there can, in fact, be no

real debate. And because they are arguing from different perspectives, it makes no sense to place the two perspectives on the same continuum.

Suggestions for improving the instrument came from Steyn (2000), who suggested that although he supports the argument, the instrument itself needs refinement.

Is it feasible to plot objectivism and constructivism at right angles rather than at 180 degrees?

Reeves (2000) succinctly answered this question:

> I think it is feasible and that it could lead to some very interesting analyses . . . One challenge of this approach, though, is to devise a way of portraying the design or implementation of an instructional program across a multi-dimensional array of the resultant matrices. I think a three-dimensional approach would be needed; perhaps someone would like to take up this challenge.

The challenge presented by the model is also pointed out by Deacon (2000), who argued that, "The two dimensional space is richer in its description but less easy to interpret because there are more interpretations." Like Reeves (2000), he thought that "any number of additional dimensions could be considered in addition" (Deacon).

Wijekumar (2000) pointed out that the two approaches are means to different ends:

> Different objectives may be more suitable for the different approaches. The assessment usually drives the approach. What I mean by this is that if multiple choice testing is used, then preparing for that type of test will be different than preparing a portfolio.

The fact that the two dimensions are assessed differently further supports putting them at right angles rather than in a straight line. In a straight line, reaching one objective would automatically mean that an opposing objective is not met.

Pelton (2000) supported this view, but questioned the relationship between the two dimensions:

> I'm not sure that the constructivist/objectivist dimensions are even orthogonal, let alone new/old. I expect that it would be difficult to find an educationally supportable activity that would be rated entirely objectivist or entirely constructivist . . . Rather, I suggest that there is sufficient commonality between the dimensions to support the notion that they are correlated to

> some degree . . .. Let's plot them as non-orthogonal, positively correlated factors . . .. If we insist that the dimensions are orthogonal, then I would suggest that pure objectivism is the training of students in knowledge and skills that they will never use, while pure constructivism is the education of individuals who will not be able to communicate with one another.

Bixler (2000) also argued that the two approaches do not function on a matrix, but completely independently of one another:

> Based on this one limited example, as well as personal observations over the years (mostly in CBT), I see the use of either (objectivism or constructivism) approach not as opposed to each other, not as complementing each other, but rather as approaches that should be used when and where they make the most sense.

The "one limited example" that he referred to, was his answer to the second question.

Can you think of a program or lesson or learning event that would score high on both?

In answer to this question, Bixler (2000) presented a case study in which:

> A series of "you are there" scenarios that are more constructivist than not (maybe a 6 on a ten-point scale) are each surrounded by objectivist-based (9 out of ten points) lessons. The lessons are available at any point in the scenario for the user to access—the idea being that users would encounter a problem or "get stuck" in the scenario, duck out to a relevant lesson, and then return to the scenario armed with the knowledge needed.
>
> So in SCORE, the scenarios score higher in constructivism, and the lessons score higher in objectivism. I guess you could combine them and say SCORE scores high in both, but as the scenarios and lessons are not simultaneous in occurrence, this may be misleading. It may be that any instructional approach that claims to use both approaches is in reality first using one approach, then the other, oscillating back and forth between the two paradigms as required.

In support of this Niu (2000) argued that even a lecture, "the most traditional of the traditional teaching tools can indeed be high in constructivist characteristics."

Both these instances support the contention that a single learning event is composed of various elements that could be characterized as either constructivist or objectivist, and that it is up to the instructional designer to determine the blend on the basis of the envisaged outcomes and objectives. As Pelton (2000) suggested:

> An ideal learning instance involves the growth of the learners both in their ability to demonstrate achievement of educational objectives, and their understanding of the world. Most teachers strive to achieve both ends. When they succeed, then you have a lesson that would score high on both continua.

A number of postings picked up on the relationship between educational objectives and relevance to the real world.

Smith's (2000) description of his ID methodology corresponds closely with the description of the Integration quadrant of the model:

> My method for determining when to use behaviorist techniques and when to use constructivist techniques is to first try to apply behaviorist rules for writing objectives and criterion. If it is easy to write an objective with clearly measurable criterion then I do so and develop the curriculum to support the objective. This is usually the case when the learning element is a task that is procedural, such as replacing a broken part in a machine. However, if I am training the student to diagnose which part is broken when the causes are not observable, the method is much more fuzzy. It can take on any number of faces depending on a complex mix of variables. Therefore, I conclude that the objectivist approach is not suitable and take on the challenging task of creating a curriculum that tries to prepare the student for contingencies that would be very difficult to proceduralize or measure. This calls for the cognitivist or constructivist approach that acknowledges the need to understand concepts and relationships. The objective is then to help the student combine their past experience with new mental models that will prepare them to solve unique problems they will face on their job. This is significantly different than training them to, more or less, memorize the procedure that was needed to replace the broken part, once diagnosed. Almost every training program I design benefits from a combination of behaviorist and constructivist technique.

Further support for the model comes from Baker's (2000) "compromise":

> [I] start with an objective or an idea of what outcomes I anticipate my learners need to accomplish or that I would like them to achieve (an instructivist notion, I know). Then, I consider the learner's characteristics relevant to the situation and the contextual constraints (for example, I teach a lot via satellite (for two hours at a time) and on the Web, for a full semester, to graduate students (many over 35) with little experience with ID and a high interest in instructional technology . . .); from there, I ask, "Is it possible to provide some semblance of generative learning here? I hope so!"

Members of the mailing list affirmed their opinion that objectivism and constructivism do not function in practice as opposites. They also thought that learning events could contain both constructivist and objectivist elements, though never simultaneously.

We investigated the feasibility of the model in two further case studies.

Results of the Two Case Studies

Two case studies are presented here. The first illustrates a learning event that was specifically designed to be high in both objectivist and constructivist elements. The second shows how the model was applied by a primary school as they planned the development of a new computer laboratory.

Case Study One: High-high

In a follow-up study, a new group of master's students were given a project designed to determine the extent to which they were capable of integrating instruction with construction. Their brief read: "Follow Gagné's ten steps of ID to prepare a *constructivist* learning event, that addresses all five of his categories of learning" (Learning and instructional design theory and practice, 2003). Students analyzed their lesson plans and video recordings of the actual learning event using Basson's (1998) spreadsheet. I decided not to adjust the spreadsheet, but to leave it in its original form to avoid introducing more variables.

This challenge was directly in line with Smith and Ragan's (1999) elaboration of Gagné's 9 events of instruction into 15, and their classification of those events as *supplantive* or *generative.*

A project by one student showed promising results. He presented a two-day radio-operator's course for the South African Civil Aviation Authority (Muuren, 2003). The course was presented to only five learners. Although we were aware that the sample was very small, and that no generalizations could be drawn, we did not question the design because we accepted that the pur-

pose of this research was to test the feasibility of the model rather than to evaluate the success of the learning event.

Muuren stated the rationale for the learning event as follows:

> The South African Civil Aviation Authority (SA-CAA), . . . from May 2003 requires that all airport and services personnel who currently make use of any form of radio transmitting device, be trained and found competent to make use of the device. SA-CAA have based this requirement on statistics from SA and around the world, which indicate that the lack [of] standardized radiotelephony have been the cause of a number of ground related incidents and accidents. (Muuren, 2003, p.1).

From the stated outcome it is clear that this learning requirement falls into both of the categories mentioned by Smith (2000) in the mailing list discussion above. Some of the outcomes are simple, rote learning elements. Others are concerned with the understanding of complex concepts, procedures, or relationships. This is also borne out by the specific statement of outcomes:

> The outcome expected by the SA-CAA is that students:
>
> - Complete a written examination on the theory of the intervention, for which the pass mark is 75%
> - Students are then expected to demonstrate practical ability, based on the theory in a practical evaluation, for which the pass mark is also 75%. (Muuren, 2003, p.1)

Whereas success in the written examination is dependent primarily on a mastery of rote learning, success in the practical examination requires that candidates use their acquired theoretical knowledge to deal effectively with scenarios with which they are unfamiliar. It was decided, furthermore, to extend the scope of the practical examination beyond the stated requirements of the SA-CAA by adding problem-based scenarios that test the ability of participants to evaluate given situations. This was done so that the highest level of Bloom's *Taxonomy* (1956) could be addressed. Learners were prepared for the written examination by an objectivist approach, and for the practical by a constructivist approach.

Table 7 contains the learning outcomes, the levels of Bloom's *Taxonomy* (1956) to be addressed by each, and an initial guess at the extent to which each outcome calls for an objectivist or a constructivist approach.

The table shows that five of the eight (63%) outcomes require a constructivist approach, while six of the eight (75%) outcomes could be achieved by objectivist means. When the learning intervention was analysed by making use of Basson's (1998) spreadsheet, a constructivist score of 62 was returned, and an

Table 7 ☐ Initial analysis of objectivist and constructivist elements (adapted from Muuren, 2003).

Learning Outcome		*Objectivist*	*Constructivist*
1. Recite each letter of the phonetic alphabet.	Knowledge	1	0
2. Use numbers correctly over the radio.	Application	1	0
3. Use the correct methods for indicating time on the radio.	Application	1	1
4. Use the correct terminologies for carrying out a radio test.	Application	1	0
5. Reply correctly when a radio test is carried out.	Analysis	0	1
6. Use the correct radio terminologies for calling aircraft.	Synthesis	0	1
7. Using the correct phonetics and numbers; read a meteorological report.	Application	1	1
8. Use correct phonetics, numbers and times; respond to unknown scenarios of a simulated exercise.	Application, Synthesis, Evaluation	1	1

objectivist score of 77. This placed the event squarely in the Integration quadrant.

The actual two-day learning event followed Gagné's events of instruction, as is shown in Table 8.

The learning event was recorded on videotape and the tape was analyzed to gauge learner reaction and performance. Interviews were conducted with all five participants, and a research diary was kept.

In the examination, all the participants scored much higher grades than the minimum pass of 75%. Surprisingly, participants scored higher in the performance-based practical evaluation than in the predominantly rote theoretical examination, even though the practical evaluation called for more skills than are actually required by the SA-CAA.

In his reflection on the learning event, Muuren (2003) discovered that objectivism and constructivism are complementary, rather than oppositional.

> One of the best findings I made during the learning event was that the theories are not mutually exclusive, and that they can all be used in a single learning event. I found that the

Table 8 ☐ The learning event and Gagné's (1985) nine events of instruction

Gagné	*What happened*
Gain attention	Learners were played a recording of an actual air control tower radio message and asked to try and hear what is being said.
Inform participants of objectives	Learners were issued with a copy of the SA-CAA syllabus with learning objectives, but also informed that the actual objective was for them to be able to display fluent and accurate radio procedure in a real-life situation.
Stimulate recall of prior knowledge	Learners were encouraged to "decipher" the radio conversation. It was discovered that they were familiar with the phonetic alphabet and could judge the appropriateness of the speed of the conversation, as well as the effectiveness, or ineffectiveness of the radio conversation.
Present stimulus	The rest of the morning of the first day took the form of an interactive lecture delivered by an instructor with a multimedia computer and large screen data projector. All the formal aspects of the syllabus were covered. Learners also worked through computer-based training modules.
Provide learner guidance	In the afternoon session, students worked through worksheets at multimedia computers. Simulated radio messages were provided by the computers and students had to evaluate these according to rubrics provided on the scenario-based worksheets. Students were encouraged to work in groups, and the facilitator was available once an hour. Finally students were once again played a recording of radio conversation, and open communication and debate were encouraged.
Elicit performance	Student performance was expected by way of worksheets, the written examination and the practical exam. Finally the original extract was played to the students again, and this time they were able to understand much more of it.
Give feedback	Feedback occurred throughout the learning event, with the instructor and peers giving feedback during the sessions when radio conversations were played, and during formal feedback sessions upon completion of worksheets.
Assess performance	Performance was evaluated during the written examination where students were expected to obtain a pass mark of 75%. An independent designated examiner conducted the practical examination. The examiner provided a different scenario for each candidate and ensured that unexpected occurrences were included, so that students had to act rather than merely react.
Enhance retention and transfer	The practical exercises were done with intercoms rather than radios. This was a deliberate strategy so that learners could learn to transfer these skills to the radio environment. Learners were encouraged to transfer what they had learnt in class to their real-life work so that proper radio procedures would be carried out. They were also asked to supply instances outside the radio-office where their newly acquired communication skills would be useful.

> behaviorist approach of imparting knowledge in an effective and efficient way, allowed me to use constructivist learning activities. (Muuren 2003, p.20)

For Muuren (2003, p.21), the success of the integrated approach lay in the speed with which learners moved from *knowledge* to *evaluation* on Bloom's taxonomy. The integrated approach also draws on the strength of both: "While behaviorist theory supports the effective transfer of knowledge, constructivist theory definitely increases the rate at which knowledge is assimilated and internalized by the participant" (Muuren 2003, p. 20).

Case Study Two: Three laboratories, three quadrants

This section describes a study undertaken by a primary school to determine the extent to which computers had been integrated across their curriculum. The school already had two computer laboratories, and was planning a third. It did not want three identical laboratories, but instead wanted each computer center to have its own specific purpose.

A master's student conducted the research for a module entitled "Computer Use in Schools" (Kruger, 2003) and found that the school used one laboratory (that it had established in 1989 and that it called the Computer Center) exclusively for drills and tutorials. Learners visited the computer center to work through software programs such as the Cami® mathematics drill program and the Cairoo® perceptual skills tutorial. The center had 40 computers. Group work was not encouraged.

The second center, the Computer Academy, established in 2001, had 35 networked multimedia machines. It was used predominantly as a place where learners could develop computer literacy skills, specifically in the Microsoft Office® environment. Learners were encouraged to work in groups because this enabled them to experiment and to learn from one another. Learners were usually given tasks that they could only perform once they had acquired new skills. A typical task might be to design a birthday invitation using a graphics package, set up an address list in a spreadsheet, and then mail merge the addresses onto individual invitations using a word processor.

It became evident that the school needed a third center because the two facilities were occupied in excess of 90% during school hours and in excess of 80% for four hours after the school had closed each day. A needs analysis showed that the school would benefit from a venue where learners could use computers to do their regular schoolwork. In the course of such work, they might need to consult the Internet for information, use a spreadsheet to calculate and generate charts, and use a word processor to write up the information

that they had generated. Some skills would require direct instruction; other skills would be accomplished in the context of project work.

The three computer laboratories can be plotted on the matrix model as shown in Figure 4.

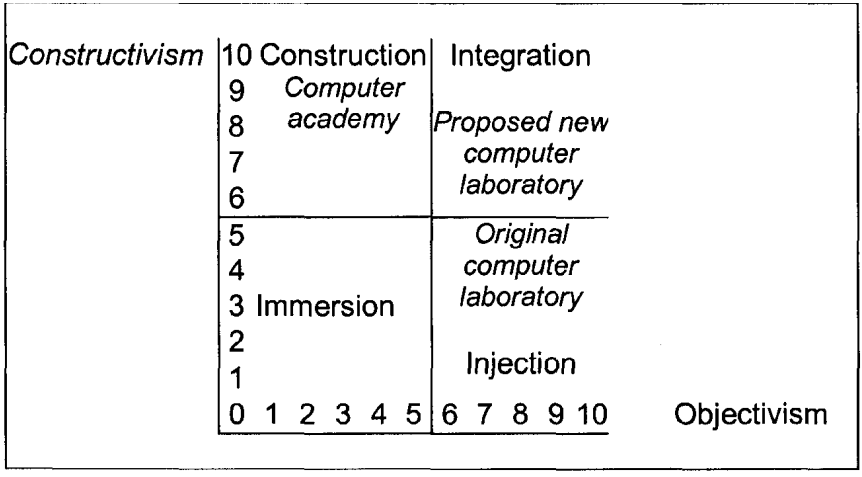
The original drill-and-tutorial laboratory functions in the Instruction quadrant. The project-based computer-skills workshop functions in the Construction quadrant. The new laboratory, for which both curriculum-based instruction and concept exploration is envisaged, should fit into the Integration quadrant.

The two case studies provide a tentative answer to the two questions that were posed to the mailing list:

For the first question, Is it feasible to plot objectivism and constructivism at right angles rather than at 180 degrees? the matrix structure generated by plotting objectivism and constructivism at right angles to one another allows for useful classification, as can be seen in the allocation of the three laboratories to three different quadrants. This reinforces Deacon's discussion list comment that the matrix structure is "richer in its description" (Deacon, 2000).

For the second question, Can you think of a program or lesson or learning event that would score high on both? Muuren's (2003) experiment showed that a learning event could be high in both objectivist and constructivist elements, and that such learning events could indeed be potentially successful *and* enhance both efficiency and effectiveness. This event was much like the

Figure 4 □ The laboratories in their quadrants (adapted from Kruger, 2003).



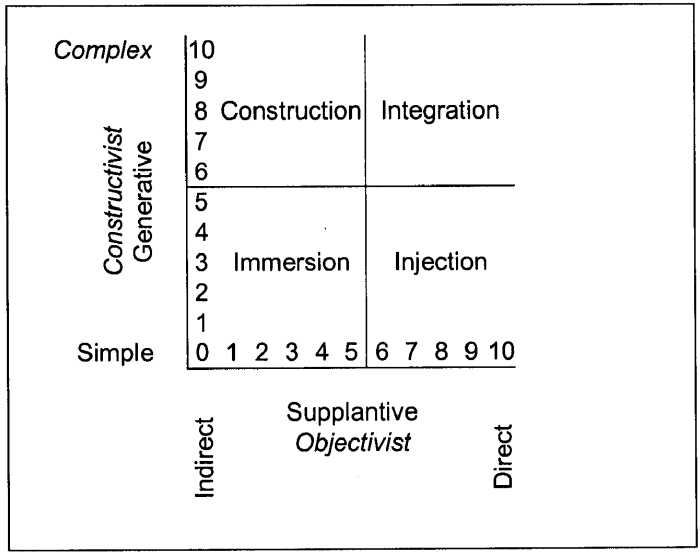
instance described by Bixler (2000). It is one event that comprises subordinate elements that draw from one or the other approach.

CONCLUSION

Many learning events or lessons contain both objectivist and constructivist elements. If a lesson or event scores high on one, this does not necessarily mean that it should score low on the other. However, as Marsh (2000) pointed out, objectivism refers to teaching, whereas constructivism, originally, is a way of understanding how people learn. I therefore suggest that constructivists and objectivists are not in debate—they are simply at cross-purposes. A model that plots them on a straight line (continuum) with polar opposites is predicated on erroneous assumptions.

If one then considers that instruction is often based on measurable objectives (Mager 1991), and that outcomes-based education focuses on the learner (Spady, 1993), the two dimensions may have to be reworked. The objectivist dimension is concerned with supplantive learning that ranges from indirect to direct. To make it simple, it could be called the "supplantive dimension." The constructivist dimension, which is concerned with generative learning outcomes that range from simple to complex, could then be called the "generative dimension." The names of the quadrants remain the same (see Figure 5).

Figure 5 □ The revised model.



The intention is that this model will make the "pejorative terms" (Pelton, 2000) that supporters of one extreme use against supporters of the other, superfluous and redundant.

IMPLICATIONS

As Muuren (2003) showed, the matrix model for plotting learning events could be a useful tool for matching teaching methods and learning outcomes with a view to increasing their efficiency and effectiveness. This further means that it could be useful in the world of corporate learning where the question may well be What works? rather than What makes it work?

As Mayer (2003) and Smith and Ragan (1999) suggested, the model could also be used when it becomes necessary to decide which technologies or methodologies one might use to achieve certain teaching outcomes or learning objectives. Many diverse ID models exist (Gustafson & Branch, 1997). The model presented above could assist in the classification of these models on the basis of the extent to which they support generative or supplantive methods.

Research into the relationships between the two axes would also be fruitful. To what extent (for example) would it be true to say that, ideally, a specific teaching objective should be matched to a specific learning outcome (Merrill, 2002)?

The study of such classifications and relationships would serve as a meeting place for both ID and LS.

More research and debate may be needed to refine the terminology used in naming the axes and their extremes. An instrument would be useful that could measure the positions on the axes according to rubrics that are more scientifically determined and open to less misinterpretation than those of Basson (1998).

Although the application of the matrix has been shown in training and strategic planning for junior school administrators, it should still be tested in other circumstances, such as in informal learning, school teaching, and even teaching and learning at college or university level.

It would also be useful to take on Reeves's (2000) challenge to make a multidimensional model based on his "Pedagogical Dimensions." □

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