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Constructivist Criteria for Organising and Designing Educational Research

How Might an Educational Research Inquiry Be Judged from a Constructivist Perspective?

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> **Context** • Ernst von Glasersfeld's radical constructivism has been very influential in education, particularly in mathematics and science education. > **Problem** • There is limited guidance available for educational researchers who wish to design research that is consistent with constructivist thinking. Von Glasersfeld's radical constructivism, together with the theoretical perspectives outlined by constructivist educational researchers such as Guba and Lincoln, can be considered as a source of guidance. > **Method** • The paper outlines a constructivist knowledge framework that could be adopted for educational research. The discussion considers how judgement of what counts as knowledge could be made, and how the set of procedures chosen could enable the researcher to represent the findings of the inquiry as knowledge. > **Results** • An argument is made for researchers to explicate the criteria for judging an inquiry. Each criterion can then be linked to the standards to be reached and the techniques for generating data. The joint satisfaction of criteria and techniques for a constructivist inquiry creates conditions that indicate the "trustworthiness" or "authenticity" of an educational research study. > **Implications** • The illustration of how a constructivist inquiry could be judged recognises how the contribution of von Glasersfeld's radical constructivism can be used to inform the practice of educational research. > **Constructivist content** • The argument presented in the paper links to radical constructivism and suggests ways in which it can be applied in the context of educational research. > **Key words** • Knowledge framework, methodological criteria, trustworthiness, authenticity.

Introduction

In a discussion in this journal on the future of radical constructivism (RC), Siegfried J. Schmidt called upon scholars to improve RC's acceptance. One suggestion he made was that work should be done to "prove its practical usefulness in solving clear cut problems in various disciplines" (Schmidt 2010: 10). Empirical studies such as those by Dewey Dykstra Jr. (2005) have contributed to an understanding of RC's practical usefulness in the field of education and this paper seeks to address Schmidt's suggestion in the context of educational research. The problem is that researchers who wish to adopt a coherent constructivist knowledge framework[1] for an educational research inquiry face a considerable chal-

lenge in ensuring that all aspects of the research project are consistent with constructivist thought. In addition to questions of ontology, epistemology, and methodology, which need to be addressed, a constructivist educational researcher also needs to consider how data should be analysed and interpreted in a manner consonant with constructivist thinking.

This paper presents an argument for how a constructivist educational research inquiry could be judged. It suggests criteria and standards against which a constructivist research inquiry could be evaluated and possible techniques a researcher could adopt. Implications for what counts as knowledge, and how research can be designed and conducted, together with considerations for empirical data analysis, interpretation, and reporting will be discussed.

An argument will be developed that RC provides a useful referent to lay the groundwork for the development of methodological and procedural aspects. A constructivist knowledge framework that could be adopted to guide educational research and practice will be outlined. In this paper, the approach is from an educational research perspective, and draws from work in RC and work in the field of education that adopts a broader constructivist perspective. In education, researchers who wish to outline a constructivist knowledge framework need to do so from the congeries of constructivist positions prevalent in education. Ernst von Glasersfeld's RC has been very influential, particularly in mathematics and science education. The work of Jean Piaget and colleagues informs many of the concepts underpinning RC (Glasersfeld 1995: 14–15) and other constructivist orientations that place their emphasis on how individuals actively reorganise cognitive

1 | The term "knowledge framework" refers to an explanation of what counts as knowledge and how the set of procedures chosen enables the researcher to represent the findings of an inquiry as knowledge.

processes (Cobb 1994)[2]. The theoretical perspectives of constructivist educational researchers such as Yvonna Lincoln and Egon Guba (2000) will also be considered. As a consequence of this, the term "constructivism" is used for work that draws from the latter perspective so that it can be distinguished from RC.

This paper could be used as a stimulus for discussion in the RC community about how to develop a radical constructivist knowledge framework, and others might wish to consider addressing the same topic as this paper from a radical constructivist perspective. This paper is not intended to provide a prescription of how educational research should be organised and designed. Rather, the intention is to suggest a useful and practicable process for educational researchers that is consonant with constructivist thought.

A constructivist knowledge framework

Different views about the nature of investigation and research into social phenomena, such as those central to educational research, arise out of the assumptions made about, and philosophical stances taken on, issues of ontology and epistemology (Guba & Lincoln 1989). Epistemological assumptions guide the researcher's judgement of the appropriateness of different methodological choices in an inquiry. Thus one of the fundamental considerations of any research inquiry is an understanding of what counts as knowledge in that inquiry. As Gabriele Lakomski expresses it:

❝ the application of any type of research method and the defense of the results of inquiry thus obtained implies a view, or views, of what is to count as knowledge. The point of preferring one set of methods over another is to believe that the

chosen set will lead to knowledge rather than mere belief, opinion, or personal preference.❞ (Lakomski 1992: 193)

It is this act of judgement – a judgement of what counts as knowledge, and how the set of procedures chosen will enable the constructivist researcher to represent the findings of the inquiry as knowledge – that forms the substance of the following discussion.

RC "starts from the assumption that knowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience" (Glasersfeld 1995: 1). It supports the idea "that the conceptual constructs we call knowledge be *viable* in the experiential world of the knowing subject" (Glasersfeld 1989: 122, my italics). Therefore, RC is not concerned with knowledge matching what is sometimes termed an "objective reality" but focuses on fit, where "knowledge can now be seen as *fitting* the constraints within which the organism's [individual's] living, operating, and thinking takes place" (Glasersfeld 1986: 108, original emphasis). Thus the judgement of knowledge is made through the specific framework from within which an individual operates, and knowledge is judged for its capacity to fit within the individual's experiential world.

Constructivism as a methodology

Any educational research inquiry should seek an emphasis on strategies and procedures that fit the constraints of the research, including the framework within which the researcher operates. But decisions about the fitness of particular procedures affect not only the viability of the study but also its quality. These decisions can only be made against a background of what the researcher is endeavouring to represent as knowledge, what constitutes legitimate knowledge, and the possible effects of the research.

In the field of education, Norman Denzin and Yvonna Lincoln have termed this the "triple crisis of representation, legitimation, and praxis" (Denzin & Lincoln 2000: 17)[3] and these three terms provide a useful

heuristic for examining the way in which educational research can be conducted. Although the second term, "legitimation," is the concept that links most directly with constructivist work, the other two terms "representation" and "praxis" have arisen in response to postmodern and poststructuralist arguments that are now deeply embedded in approaches to educational research. These two concepts are concerned with reporting research and the effects of research, issues that may not necessarily be foregrounded in a theory of knowing and learning such as RC. However, the ideas associated with "representation" and "praxis" will be discussed in terms of how these could be consonant with constructivist thought and incorporated in a constructivist knowledge framework.

"Representation" is concerned with how the experience of research participants is represented in the text reporting the study. This arises from poststructuralist and postmodernist work in different disciplines, including education, that highlights that any written text that purports to capture the direct experience of the research participants is limited in its capacity to do so. This has implications for educational research because postmodernism sees knowledge as dependent on "socio-cultural practices and contexts, unacknowledged values, tacit discourses and interpretive traditions" (Usher, Bryant & Johnston 1997: 207), regardless of the procedure used. The postmodernist rejection of grand narratives underlines the importance of the plurality of possible perspectives from different groups of people in connection with class, ethnicity, and gender (Agger 1991). For the researcher, this means that all texts "are always partial and incomplete; socially, culturally, historically, racially, and sexually located" (Lincoln 1995: 280). Poststructuralist positions that are embedded in educational discourse and thinking reinforce this and present challenges to the traditional assumptions about the ways in which texts are written and how they are interpreted by the reader.

The impact of language, discourse, and power on any knowledge claim raises doubts about authoritative knowledge in a social world. As an educational researcher,

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2| I am grateful to an anonymous reviewer for suggesting that Lev Vygotsky's work did not contribute to the formulation of RC and for drawing my attention to the different views of von Glasersfeld and Vygotsky on the issue of the nature of knowledge (Glasersfeld 1995: 141–142), and the different epistemological positions of Vygotsky and Piaget (see Vygotsky 1962).

3| Denzin and Lincoln used the term "crisis" to highlight how educational researchers need to

question hitherto key assumptions of educational research.

it is necessary to heed the words of Thomas Schwandt, who believes:

> "…we must learn to live with uncertainty, with the absence of final vindications, without the hope of solutions in the form of epistemological guarantees. Contingency, fallibilism, dialogue, and deliberation mark our way of being in the world. But these ontological conditions are not equivalent to eternal ambiguity, the lack of commitment, the inability to act in the face of uncertainty." (Schwandt 1996: 59)

As part of demonstrating an understanding of the uncertainty and mutability of knowledge, the two terms "reflexivity" and "positionality" are often used by educational researchers. "Reflexivity" refers to the questioning a researcher engages in regarding representations of the self and others, and the implications of one's own practice of research, in the research process. It concerns ways in which the process and the products of research are affected by how the research is conducted and the individuals involved in the research (see Pillow 2003 for further discussion). "Positionality" refers to a researcher's elucidation in the research text of her/his own background experiences and standpoint in social, cultural, political, and other relevant terms, and how the text is necessarily situated within that standpoint. Reflexivity about the values, assumptions, and methodological choices will not ensure that embedded subtexts related to aspects of positionality are transparent, but it helps to reveal the researcher's perspective and interests (see Lincoln 1995 for further discussion). The location of any educational research text in social, cultural, historical, ethnic, and gendered terms is incontrovertible and different readers will interpret any text differently.

"Legitimation" refers to verification issues associated with the inquiry. Some educational researchers have argued that canonical criteria such as external validity, internal validity, reliability, and objectivity, are underpinned by a positivist ontology and epistemology, and are inappropriate, particularly in interpretivist inquiry. In response to this, Guba and Lincoln (1989: 233) developed criteria for "verification" that they posit are more appropriate for constructivist inquiries. These criteria are suggested as

replacements for, and are in parallel to, the traditional criteria. The implication of correspondence with positivist criteria, at least in terms of axioms, is a limitation acknowledged by Guba and Lincoln (1989: 245). However, their criteria of transferability, dependability, confirmability, and credibility represent a useful starting point for the consideration of criteria within a constructivist methodology and will be discussed in further detail in the next section.

The third term highlighted by Denzin and Lincoln (2000), "praxis," is shaped by legitimation and representation, and relates to whether or not it is possible to effect social change. An assumption that conducting a research study will always effect change, or that it is desirable to effect change, ignores the complex web of political and pragmatic considerations. Further, it may represent a value-laden position that assumes that Western notions of emancipation and empowerment are appropriate and desirable in all contexts, including non-Western ones. As Clive Seale (1999: 10) argues, "societies which value conformity, based on an uncritical trust in authority and tradition, are routinely stigmatised in such a view," and any privileging of Western ideals of praxis could be inappropriate in educational research studies conducted in different societies. Moreover, political sensitivity is an integral part of methodological awareness. The ethical responsibility *qua* researcher to consider potential ill-effects on participants as a result of a study could override emancipatory ideals in research contexts where political conditions warrant caution. Where there is a risk of harm to participants, researchers would need to take into account any risks associated with pursuing aims of social change.[4]

4| This argument relates to research that involves human participants and would not necessarily be applicable in cases that do not involve human participants. The researcher would need to consider the risks to her or himself *qua* researcher if there are no human research participants. If there are human research participants, then "an ethic of respects for any persons involved in the research they are undertaking" (British Educational Research Association 2011: 5) implies research that does not result in harm to a research participant.

Criteria for judging an inquiry with a constructivist knowledge framework

Criteria that are used for the assessment of the validity, or "trustworthiness" (Guba & Lincoln 1989: 233), of an educational research inquiry signify characteristics or qualities that relate to how the research will be considered legitimate. Criteria are not absolute, and methodological criteria can be expected to be context-dependent, given that methodological decisions are contextualised within any research study. A researcher could be expected to explicate the standards expected for each criterion rather than rely on implicit assumptions. As these criteria may be used in any evaluation of the research study, it is also necessary to provide an explanation of possible techniques that can be used to realise the expected standard.

In the following section, methodological criteria based on Guba and Lincoln's (1989) trustworthiness and authenticity criteria that can be used to conduct a study will be addressed. An appropriate standard for each will be outlined, as well as the techniques through which the standard could be realised during the research process. These are summarised in Table 1 and Table 2. Each of these elements contributes to a network; and it is the holistic strength of the network that counts in the research, not any one isolated aspect. In a qualitative judgement about a research inquiry, the overall configuration is what matters, and it is on this basis that a constructivist research inquiry should be able to withstand scrutiny.

The criterion of transferability relates to the traditional concept of external validity and is concerned with the applicability of the data and findings to different settings. As discussed earlier, the corollary of the influence of postmodern and poststructuralist arguments in education is that decisions about the extent to which the findings are transferable to other contexts may be more easily made by the reader of the research text. Although the onus is placed on the researcher to inform the reader adequately through "thick description" (Geertz 1993: 3), the reader could be placed in a more privileged position than the researcher to decide upon the extent of transferability to other contexts. As Lincoln and Guba suggest:

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Criteria	Standards	Techniques
Transferability (the ability to generalise within and beyond the context of the study)	Reader is adequately informed, through explication of procedures and the context, to be able to accept or reject the applicability to other contexts.	portrayal using "thick description" (Geertz 1993) statistical generalisation from sample to population "fuzzy generalisation" about the case (Bassey 1999: 72)
Dependability (the ability to replicate the study and achieve the same results)	Researcher demonstrates reflexivity and presents logic for decisions related to research procedures. Researcher provides adequate explication and justification for those decisions.	"dependability audit" (Guba and Lincoln 1989) explanation of context within which procedures used for statistical generalisations are conducted
Confirmability (the ability to offer a "transparent" account)	Data, and interpretations from the data, are documented and supported.	explication of context (with "positionality" as a subset) clear and unambiguous coding schemes of qualitative data adequate "knowledge management" of data adherence to conventions for statistical methods
Credibility (the ability to construct a coherent account of the study)	Work has representation of each research participant's constructions distinguished from researcher's own constructions and representations.	demarcation between raw data and interpretation of data, and maintaining representation of voices of participants explication of different frames of reference held by participants and researcher internal validity of statistical instruments
Fairness (the ability to construct a study grounded in ethical principles)	Researcher justifies ethical decisions underpinned by a maintenance of trust between the researcher and participants.	informed consent, avoiding coercion, providing relevant information, respect for privacy and time, not withholding benefits, respect and honesty, maintaining confidentiality and anonymity (Wellington 2000)

Table 1: Explication of methodological criteria (trustworthiness), standards, and techniques (terminology for criteria adapted from Guba & Lincoln 1989). Note: The notion of "informed consent" in educational research is drawn from guidelines for educational researchers provided by, for example, the British Educational Research Association.

"Whether [working hypotheses] hold in some other context, or even in the same context at some other time, is an empirical issue, the resolution of which depends upon the degree of similarity between sending and receiving (or earlier and later) contexts. Thus the naturalist cannot specify the external validity of an inquiry; he or she can provide only the thick description necessary to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility." (Lincoln & Guba 1985: 316)

Regardless of whether qualitative or quantitative procedures are used, the principle behind transferability remains the same: judgements about similarity between the receiving context (or the population) and the sending context (or the sample) could be made more readily by the reader in instances where the reader has greater familiarity with the receiving context.

The criterion of "dependability" draws from the traditional notion of reliability, or the consistency of the study. "Reliability" refers to the idea that if the study were replicated under the same conditions the results would be the same. This meaning of reliability is more problematic in studies that are socially, culturally, and historically situated. "Dependability" relies on an adaptation of the notion of reliability and refers to the potential replicable nature of the study. In other words,

"given the theoretical perspective of the original researcher and following the same general rules for data collection and analysis, plus similar conditions, another investigator should be able to arrive at the same general scheme." (Corbin & Strauss 1990: 15)

Thus, "dependability" in this study refers to adequate explication of the context and decisions about procedures, data generation, and data analysis, including justification for any changes in qualitative procedures as the research matures. Guba and

Lincoln (1989: 242) refer to this as a "dependability audit."

The criterion of "confirmability" is a replacement for the traditionally "neutral," or "objective," stance expected by researchers, in keeping with a realist philosophy where a researcher aims to understand a "real world" separate from the values and biases of the researcher. For an educational researcher, a transparent explication of the contextual features of the research and the "positionality" of the researcher is preferred as an alternative approach and is compatible with the RC position that "does not say there is no world and no other people, it merely holds that insofar as we know them, both the world and the others are models that we ourselves construct" (Glasersfeld 1995: 137).

The criterion of "credibility" is derived from internal validity, the latter premised on a "correspondence" theory of truth and the ability of the data to match an external reality. "Member checks," which refers to "the process of testing hypotheses, data, preliminary

Criteria	Standards	Techniques
Originality Authenticity (the ability to construct an original work)	Work is judged by peers to be an original study.	explicates new perspectives on new territory, or familiar territory in a different context
Emancipatory Authenticity (the ability to effect social change or emancipation)	Researcher demonstrates political, pragmatic, and ethical reflexivity.	explicates appropriateness or otherwise of emancipatory position avoids harm to participants arising from conduct or publication of the study

Table 2: Explication of methodological criteria (authenticity), standards, and techniques (terminology for criteria adapted from Guba & Lincoln 1989)

categories, and interpretations with members of the stakeholding groups from whom the original constructions were collected" (Guba & Lincoln 1989: 238f), are often considered essential for establishing credibility. However, this assumes that research participants view the process through the same frame of reference as the researcher, and that "taken-as-shared consensual meanings" (Cobb & Yackel 1996: 185) and understanding of the interpretations can be developed. Assertions that research should "open each [of the concerned parties] to critique in the terms of other constructions, and provide the opportunity for revised or entirely new constructions to emerge" (Guba & Lincoln 1989: 89) necessitate a conducive political climate. While this position is reasonable to adopt by the researcher and interested readers (as concerned parties), beyond this it represents an ideal.

Abstaining from the use of member checks then involves alternative measures. One mechanism is that credibility could be contingent on ensuring that the researcher's own expressions of understandings and meanings are clearly distinguished from the expressions of the participants in the study, an essential part of the quest to construct a coherent account of the research.

For educational research that is conducted within teaching communities, there are expectations about the roles and responsibilities of different participants such as teachers, students, and researchers. Teacher-researchers conducting research in the institution in which they work find it necessary to balance the dual roles of educational researcher and institutional "insider," as well as appreciate the expectations of teacher-colleagues and students who are participants. Thus, engaging in these types of studies involves making practical choices in relation to these factors that chart the course of the research. This is because principles to guide the researcher often exist in tension with the assumptions, values, and behavioural norms of the research context. Further, throughout the research process, researchers need to be cognisant of the prevailing norms of the institution.

Richard Pring suggests some general rules for conducting educational research. Amongst others, one relates to the "right of reply from those who have participated in the research but who may believe that alternative conclusions could be supported by the data" (Pring 2003: 63). This can be linked to the Duhem-Quine thesis that observations are always to some extent "theory-laden" and that theories are always "underdetermined" by the empirical evidence (Quine 1980: 41f). This idea has an impact on the extent to which participants are involved in the creation of the research text and the interpretation of the data.

The extent to which participants have input into the final research text can vary. One option would be to create jointly the research text where participants and researcher are intimately involved in the interpretation of the data. However, this would ignore "the recognition of the possibility that it may be neither feasible nor possible to harmonize observer and 'insider' perspectives so as to achieve a consensus about 'ethnographic truth'" (Angrosino & Mays de Pérez 2000: 678).

This approach also fails to consider that in order to "co-create" the research text, participants are required to consent to higher levels of participation in the research process. A shift towards "reciprocity" in the research relationship (Lincoln & Guba 2000: 182) requires the willingness of participants to assume a greater role in the research process than is required in research where the researcher is predominantly responsible for most research decisions.

Ethical considerations

The criterion of "fairness" relates to the "ascertaining and presentation of different value and belief systems represented by conflict over issues" (Lincoln & Guba 1986: 79) that inevitably emerges in the research process. Inherent in this conflict is the differential power relationship between the researcher and the participants. Thus ethical issues are an important aspect of fairness.

RC may "imply a starting-point for the development of an ethical system, not the system itself" (Glasersfeld 2009: 119). Other constructivist work that provides direction includes that of Heinz von Foerster (1995: 7), who, in a discussion on ethics, stated that "only those questions that are in principle undecidable, we can decide." Thinking related to the "biology of love" (Maturana & Verden-Zöller 2008: 81), which illuminates the importance of accepting the legitimacy of others, is also useful.[5] However, this work would need to be interpreted within ethical guidelines for educational research provided by, for example, the British Educational Research Association (2011).

5 | I am grateful to an anonymous reviewer for drawing my attention to these points.

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These frame a number of different responsibilities for the educational researcher to ensure that they "operate within an ethic of respect for any persons involved in the research they are undertaking" (British Educational Research Association 2011: 5). From these, educational researchers need to "construct a set of rational principles appropriate to their own circumstances and based on personal, professional, and societal values" (Cohen, Manion & Morrison 2000: 71). Jerry Wellington (2000: 57) outlines eight guidelines that provide a useful heuristic for the researcher. The guidelines can be classified as follows: seeking informed consent from research participants, avoiding coercion of individuals to participate in the research, providing relevant information regarding the study, avoiding deception about aspects of the research, respecting participants' privacy and time, fairness – not withholding benefits from participants, fairness – respect and honesty for participants, and maintaining confidentiality of data and anonymity of participants' identity. These guidelines can be considered and interpreted in turn in order to make contextually-sensitive judgements related to the design, conduct of the research, and how it will be made public.

Lincoln and Guba (1986) also refer to four other "authenticity" criteria. They use the following terms: "ontological" – the extent to which the study aids individual understandings to become more informed; "educative" – the study's contribution to how individuals appreciate the understandings of others; "catalytic" – how practical action is stimulated in response to the inquiry; and "tactical" – whether the inquiry is "empowering or impoverishing, and to whom" (Lincoln & Guba 1986: 82). The first two criteria can be collapsed to form one criterion under the label of "originality authenticity." This label avoids confusion arising from Lincoln and Guba's (1986) particular use of the word ontological. The new label reflects the meaning of the criterion more appropriately. If the study offers new perspectives on familiar territory, or offers perspectives on new territory, then it is able to contribute to making the researcher or the reader more informed about her/his own understandings, and with a greater appreciation of the understandings of others.

Research questions

Contributions from the RC community that could inform educational researchers wishing to conduct research using a radical constructivist knowledge framework that is practicable would be useful. Future work of benefit to educational researchers would include studies that explore various ways in which the criteria explicated in this paper could be adapted to reflect an RC perspective. Such studies would help to provide insight into how educational researchers who wish to adopt an RC knowledge framework can select appropriate sets of criteria and techniques when designing research. Following this, educational researchers could begin to explore such questions as: Are there additional criteria applicable in particular strands of educational research? Are there other techniques that researchers have used successfully and how do these connect to particular criteria? Further, studies that not only adopt a radical constructivist knowledge framework but also investigate aspects of RC with implications for educational practice would be of particular interest. These will inform educational researchers wishing to create knowledge in order to further educators' understanding of teaching and learning.

The catalytic and tactical authenticity criteria are relevant only in contexts where the goals of the study directly include ones of social change, or emancipatory action. To reflect this interpretation, the label of "emancipatory authenticity" is used to denote the criterion. As noted earlier, political, pragmatic, and ethical considerations should be taken into account.

The criteria and techniques mentioned above are not necessary, in a logical sense, but it can be taken that they would be sufficient to judge the quality of a study. In a particular educational research study, any of these criteria may be satisfied to a greater or lesser degree but their joint satisfaction to a high degree creates conditions that indicate the trustworthiness and/or authenticity of the study.

This joint satisfaction to a high degree creates conditions for knowledge from an educational research study that can be judged for its capacity to "fit" within the experiential world of the educator. From the perspective of RC, an important question is: Does this knowledge from the study fit the constraints within which the educator's "living, thinking and operating takes place"? (Glasersfeld 1986: 108). Thus, within a constructivist knowledge framework, criteria such as those outlined in Tables 1 and 2 are recommended as a source of guidance for educational researchers.

Although the preceding discussion regarding methodological criteria, standards, and techniques is in the context of educational research, it is likely to have wider applicability to other forms of social science research inquiries. In one respect, however, educational research is distinctive.

One of the aims of educational research, as a field of inquiry, is to advance knowledge of learning processes. A constructivist inquiry in education is therefore concerned with constructivism not only as a knowledge framework but also, in certain cases, with constructivist-related areas as the focus of the inquiry itself. An example of this would be a study that investigates classroom pedagogy informed by constructivist thinking. This type of study implies certain responsibilities for the researcher in respect of credibility. That is, where the focus of the research is on constructivist-related pedagogical issues, the expectation that the researcher will adopt and explicate a constructivist knowledge framework would be stronger. This connects with the "credibility" criterion in Table 1.

From the perspective of realism, the claims a researcher makes from the research study aim to reflect or depict an independent, knowable "real world." In Humberto Maturana's (1988: 41) words, "the quest for a compelling argument" may mean researchers take actions to impose "views on the other without reflection, *de facto* negating him or her."[6] In contrast, from a construc-

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tivist perspective, an educational researcher would hope that the findings of an educational research inquiry will "perturb" the educator's assumptions and ways of thinking about the learning process (Cobb 2011: 159). In order to eliminate such perturbations, the educator might change her/his understanding see Glasersfeld 1995: 65–68, for further discussion on this point).

Conclusion

The preceding discussion has suggested a coherent approach for researchers aiming to conduct educational research using a constructivist knowledge framework. The epistemological assumptions explicated by von Glasersfeld (1995) in his work on RC together with Guba and Lincoln's (1989) trustworthiness and authenticity criteria for a constructivist research inquiry suggest useful ways of organising and designing educational research. Certain methodological criteria – transferability, dependability, confirmability, credibility, fairness, and originality and emancipatory authenticity – were explicated alongside standards and techniques that can be used in educational research. Researchers can select appropriate sets of criteria and techniques according to the design of the particular research study. The criteria can then be used to judge the quality of the educational research study within a constructivist knowledge framework. This allows for the judgement of quality to be a practicable process for researchers. In this way, von Glasersfeld's oeuvre in epistemology can be seen as providing a basis for guiding educational researchers when they are designing research studies.

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