Radical Constructivism

Constructing Constructivism

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> Context • The paper is a selective survey of radical constructivist (RC) research that relates to education.  
> Problem • Over the past 40 years there have been developments in the research reviewed. Earlier work was often concerned with conceptual clarification and showing different ways children and teachers think, whereas recent work is more systemic and applied.  
> Method • Research with educational implications done by the author and colleagues is surveyed. This survey shows how RC influenced research in a variety of psychological domains including attitudes to different others, science education, and teacher professional development.  
> Results • While initial work by the author in this area focussed on conceptual clarification, the more recent work is classroom-based, with implications for educational practice in schools. The final part of the paper on research by colleagues emphasises how teachers might work together in schools and the broader school system.  
> Implications • RC plays a significant role in national curricula as a theoretical approach to facilitating diversity in schools and empowering children in their education. There is an urgent need to focus on student learning. The work on educational applications cited provides important insights into the resolvable problems of enabling genuine learning communities.  
> Key words • Dewey, Piaget, process, certainty, education, facilitating learning.

Introduction

1. Noam Chomsky wrote Syntactic Structures in 1957. The book was a challenge to the predominant behaviourist approach in American psychology and linguistics. Jean Piaget’s (1970a) own structural approach was also in this tradition and had been introduced to American psychology by a number of researchers such as John Flavell and David Elkind at the University of Rochester. Piaget’s approach was in a number of ways similar to ideas expressed earlier by philosopher John Dewey (Gash 1974), so Piaget’s (1970b) educational volume provided a bridge between his psychological ideas and their educational application.

2. Dewey’s (1960) writings about epistemology raise questions about our common sense understanding of reality, that is, that ideas represent reality. As Dewey (1960) put it, ideas are the result of mental operations. In the history of philosophy, Berkeley’s theory of knowledge (1975) is well-known for asserting the impossibility of going beyond ideas. But there is that “stickiness” of the idea that what we perceive is “there as part of a real world” (Glasersfeld 2010: 19). Silvio Ceccato (1961) put this well when he said that epistemology is introduced as a topic when the idea of an external world is well-established and so we do not question it, rather it is assumed. Of course, in many circumstances we do pretty well with the assumption. However, in Ernst von Glasersfeld’s last paper (2010), this emphasis on the impossibility of making any correspondence between what we know and reality is emphatic. This is a distinguishing feature of radical constructivism.

Stages of constructivist thinking

3. Since Piaget (1967) used the phrase “constructivist epistemology,” many people have written about constructivism. Von Glasersfeld (1974) introduced the phrase “radical constructivism” (RC) to emphasise a break with the traditional epistemology that considered truth as a verification of knowledge as a representation of reality. While this aspect of constructivism was novel, it is a corollary of Dewey’s view of the relation between ideas and reality. Constructivist thinking forms a multi-layered set of concepts interpreted in a variety of ways by the communities of people who use the word. It involves a series of ideas including the following:

1. Children’s ideas are very different from adults.
2. Children seek to discover regularities in their experience using existing ideas.
3. This process of discovery is a construction.
4. This constructive process is circular and recursive. That is to say, ideas are always modified by ideas — it’s all internal, what we know of outside depends on our sense receptors that provide internal data.
5. Learning is limited or constrained in two ways, that is, by two sorts of conservations: intra-individual consistency and inter-individual consistency.

4. In Gash (1995), I suggested it would be appropriate to think of stages in the emergence of the constructivist epistemology in the study of cognitive development. The first stage involves appreciating that knowledge is constructed. The second stage includes recognizing that radical constructivism implies that there is no match possible between knowledge and reality, and the third stage involves teasing out the ramifications of this counter-intuitive position in one’s social world. It can be argued that a de-
description of the development of constructivist ideas applies both to the literature about constructivism and to ways individuals come to understand it. A historical survey of the literature is beyond the scope of this paper, but indications of how RC and the social context influenced the author's research emerge in what follows here.

« 5 » Piaget's stages reflected qualitative differences in thinking. As such, stages remain an explanatory construct to introduce changes in ways cognitive development is constructed individually and socially. Von Glasersfeld's (1974) article brought a new paradigm to developmental psychology with its radical constructivist interpretation of Piaget's theory. So, from the standpoint of the present article, work on cognitive development after 1974 can be seen with a new focus. Indeed, von Glasersfeld's prioritisation of the importance of the personal nature of understanding later led to calls to emphasise the import of the social context of learning and to considerations concerning the compatibility of RC and social constructivism (Confrey 1995). Gash's (1995) suggestion that constructivism might be thought about as a process with stages was initially a pedagogical device to introduce these ideas to students, though describing aspects of cognitive development in terms of stages was a well-established tradition (Kohlberg 1969).

« 6 » The first stage typified textbook presentations of Piaget in the 1970s. These early interpretations of Piaget's theory defined learning as a consequence of interactions between children and their environments. Lawrence Kohlberg (1969) presented cognitive development as the result of an interaction between "nature" and "nurture." This was a compromise between accounts of human learning that depended either on environmentalist positions represented in various learning theories, or that depended on strong nativist positions like Chomsky's. In the interactionist view, the child is seen as possessing inferior knowledge and who by interacting with the physical and social environments comes to understand the world in more sophisticated ways. The child resolves differences between child and adult accounts of experience by recognising the superiority of adult thinking. An implicit assumption is that the child is thinking in an invalid way, with the corollary that forms of knowledge vary in terms of correctness rather than in terms of their (implicit) assumptions. The first three elements in the constructivist model, as I presented them above, fit comfortably as an explanation of this type of understanding. Indeed, this first stage also fits with the idea of children seeking the best organisation of available information. However, Wohlwill (1973) stressed the importance of recognising and taking steps to correct the loose usage of the words "environment" and "experience" by psychologists.

« 7 » In Gash (1995), I saw radical constructivism as the hallmark of a second stage of understanding intellectual development. It involved a fundamental rethink of our concepts of knowledge and our relationships to the environment. Von Glasersfeld introduced the phrase "radical constructivism" in the 1974 article to clarify what a consistent constructivism implied (see also 1987, 1995b). Two elements of constructivist thinking mentioned above are crucial: (1) the circular nature of thinking; and (2) a recognition of the limits on what is known. Circularity is illustrated by a piano player playing a short piece of music, over and over again in a repetitive or circular way, so that eventually the player plays it flawlessly in exactly the way he wants. An important part in this process is the exercise of control by the learner. Adjustments are made in the form of negative feedback on the outcome of each repetition, so that eventually there is no discrepancy between what is experienced and what is desired. "This is an observable commonplace example of circularity. In the act of trying to understand any experience, the repeated efforts of a person are circular, but they are also recursive: that is, the results of each effort to understand will feed into the next such act. In this way, RC prioritises intra-individual consistency. A crucial feature is that new ideas first arise internally in an individual.

« 8 » It is so important not to have fixed ideas about reality. This is because we live in language in a social world, and so the constraints for inter-individual consistency invite one to accept the convivial illusion of the accepted reality. While the balance in different societies between individual and social responsibilities varies, the insight RC proposes is that societal change requires individual ideas and initiatives. One's responsibility to oneself requires that one accepts responsibility for one's own ideas and feelings and the practical ethical implications and challenges of these ideas. However, one's own ideas arise from one's own set of historical circumstances and are not the only way to interpret experience. So there is an ethical invitation to see that others with different circumstances have their right to their different views.

« 9 » The third stage in Gash's (1995) formulation of different ways of thinking about constructivism brings the social dimension into sharp focus. Where a critical aspect of the second stage was the importance of the personal nature of the act of constructing, the critical aspect of the third stage is the recognition that personal constructions require social support to be viable. Thus, there is a move from prioritising intra-individual consistency in the second or radical-constructivist stage, to an appreciation in the third stage of the importance of inter-individual consistency. The importance of social constructivism or constructivism calls attention to the importance of the social milieu in providing conditions for constructions to grow (e.g., Ackermann 1991). There have also been movements away from Piaget and towards Vygotsky. This might be seen as a general development from an earlier stage that recognised the importance of the personal nature of constructions, to an emphasis on, without relinquishing this idea, there being a recognition of the importance of social support for such constructions. Empirical work presented in this paper on representations of learning disabilities draws attention to the importance of social support in maintaining prejudice. The attitudes people have about value-laden issues are part of their identity, and form part of a coalition of relationships in a person's group of friends. As Joseph Dunne put it, "self-understanding is always an understanding of one's relatedness to others and to the good" (1995: 151). Peers will notice altered attitudes immediately, and if the original attitude is important to one's group of friends, one is likely to be challenged or rejected for changing one's mind.

« 10 » This third stage is presented with an emphasis on the importance of the so-
Research phases, influence of RC

My early writing about constructivist ideas concerned (1) the history of the ideas (Gash & Glaserfeld 1978) and (2) the transfer of learning between similar ideas in different domains. Piaget's stage model proposed that learning in one domain, such as classification of physical objects, might influence another domain, such as social thinking. In the 1960s and 1970s it was becoming clear that evidence in support of Piaget's idea of the “stage” of concrete operations was sparse, though there was a lot of interest in “training studies,” especially in relation to conservation. There were studies looking at primary school children of different ages to see how a simple measure of role-taking was associated with the ability to do class inclusion. The aim was to find evidence of cross-domain associations or “transfer of learning” in the development of these ways of thinking. There was some limited success in showing how training in role-taking influenced class inclusion skills (Gash 1982). Rebecca Bigler (1995) later provided more robust evidence of such association in the case of multiple classification and gender stereotyping. She demonstrated that training in multiple classification reduced gender stereotyping. A significant element in Bigler’s approach was to provide children with experiences of multiple classification as a way of attuning them to think more flexibly about stereotypes. However, in spite of studies showing cross-domain transfer, the contemporary tendency in psychology is to study children’s thinking in different domains such as cosmology, biology, and psychology (Gopnik et al. 2004). Von Glasersfeld studied mathematics as an undergraduate, and this may have been an element in the fruitful relationship he had with mathematics educators. Certainly, much of the work that was initiated at the University of Georgia on RC had an impact on mathematics education (Steffe & Thompson 2000). The author’s application of this constructivist framework was concerned with identifying children’s cognitive constructs in different domains as a point of departure for reflection or to facilitate change. The constructs include gender stereotypes, representations of learning disabilities and of heroes, and representations of learning. In each case, part of the work was based on stage two constructivism, that is, the work aimed to describe different ways that children represented their experience. One reason for making this (stage two RC) identification of concepts was to enable teachers to know how children thought so as to be able to facilitate cognitive development.

Children’s representations of others

Gender stereotypes

Piaget noticed that there were certain limits to young children’s thinking about quantities in relation to physical phenomena and other limits that concerned their perceptions of others. His theoretical framework gave rise to an enormous body of research, some of which supported Piaget’s ideas and some of which led to refinements of his ideas. Piaget identified intriguing features of child cognition. Examples include the concept of object permanence and, in the early school years, the conservations and egocentrism. In the 1980s, there were approaches to domains such as thinking about gender that were congenial to constructivism. We can consider ideas about gender, for example, as conservations. In other words, gender stereotypes are rigid ideas a child has about girls and boys, and this make it easy to think about ways gender differences are conceptualised. In life, stereotypes do not fit experience well in many cases, but clearly they fit experience well enough for certain people in limited contexts. Thinking about stereotypes as conservations within a constructivist framework allows teachers to think of them as temporary conservations that are open to change in a larger framework of experience, rather than just as politically incorrect ideas.

RC influenced a European Project designed to promote equity in education for boys and girls in the late 1980s (Drudy et al. 1991). It is intriguing to remember that an aim in one of the participating countries was to ensure that computer studies was not considered a male preserve, and that there were career opportunities for girls too in the digital domain. In one of these studies (Gash & Morgan 1993), the aim was to establish whether primary school children’s thinking about gender could be challenged in ways that would facilitate a change in their representations. The project was a field experiment where children were given a standard test of gender stereotypes before and after an educational intervention in classrooms in schools participating in the project. There were some indications that this type of intervention helped children be more flexible about their stereotypes in ways that remained a year later. Further, the experience sensitised teachers to equality issues in positive ways. This model of looking at children’s thinking before and after classroom experiences was one that suited researchers and schools in Ireland at the time. So the practice of looking at children’s representations on other topics, and, where possible, challenging their thinking or making comparisons between children with different circumstances, led to further work on ideas about special needs, about children from other countries (Gash 1995), and about heroes (Gash & Conway 1997).
Representations of learning disabilities

To study children’s representations of children with special needs, a questionnaire was used that posed a series of questions about a child with learning difficulties and asked for words used to describe this child. In such a procedure, one difficult issue concerned how to ask the same question to each child in the study, that is, how to present as similar as possible an image to each participant. In Ireland at the time, use of the phrase “mental handicap” was declining and children who were resident in special schools became known as children with “learning difficulties.” The phrase “mental handicap” was politically incorrect. Over the course of this series of studies in the 1990s, the phrase used in the test changed from “a child with a mental handicap” to “a child with special needs.” Aside from the issue of political correctness, another reason for these changes in the questionnaire was to try to ensure that children in different classrooms were all thinking about a child with learning difficulties who was as similar as possible. In the end, we thought that using a picture of one child with Down syndrome seemed to be the most satisfactory strategy to meet this requirement, i.e., to stabilise the image when presenting a questionnaire to children in a variety of classrooms (Gash et al. 2000). The approach taken in these classroom interventions was simple – at least in design. Taking a constructivist educational approach meant the teacher was interested in presenting a broader experience to the children in relation to the topic in question, whether this was their construction of a gender stereotype, or an idea about a child with learning difficulties, or about a child from another specific country. A constructivist approach was not one that prescribed what the teachers and student teachers presented to the children in primary schools during these interventions. Instead, researchers asked questions and provided counter-examples to challenge children’s ideas about the topic.

These intervention studies showed that boys and girls have different attitudes about children with learning difficulties, that boys are more negative, and also awareness of the educational issues in relation to inclusive practices developed with age and experience. The profiles of ways children think were important to anyone planning work with children to invite them to reflect on their attitudes towards children who are different with the aim of encouraging more inclusive and accepting constructions. In all classroom discussions, it is important to know how the children think or what they know about the topic. These studies opened up aspects of ways children think about different others. One school principal remarked that the lessons the children had about learning difficulties facilitated the arrival of a child who had hearing difficulties in the school in the September following the intervention. The children also learned about the real difficulties children might have in mainstream classrooms and so appreciated that inclusion might be difficult.

It is also interesting to note that these studies led to an emerging synergy between the different levels in the education system. What initially began as an opportunity to learn about the effects of constructivist teaching for student teachers, was now showing effects in the school system in terms of the pro-social attitudes the school children were learning. There were also positive educational contacts between different parts of the education system, schools with their teachers and children were meeting and working with students from the college of education in new positive ways.

There were some difficult moments. Some teachers felt it was better not to ask these questions about children with learning difficulties – just in case the children participating might be more prejudiced after completing the questionnaire. In fact, simply completing the questionnaire was sufficient to sensitise the children to the issues, and not sufficient to change attitudes in positive ways. Pupils, for example, often changed their ideas the second time they completed the questionnaire. The process of changing children’s attitudes towards children with Down Syndrome, for example, would seem to require first an opportunity to be able to express their lack of experience, and even discomfort in some cases, concerning children with Down Syndrome. Children need time and opportunity to come to know children with Down Syndrome to form positive relationships. The student teachers who facilitated the interventions were anxious to move gently and not to be seen as “to preach,” whether the domain was gender, learning difficulties, or national origin. Each of these issues involved identity and the teacher–pupil relation needed to respect this. However, the student teachers who initiated the interventions to promote positive attitudes found the questionnaire method of checking the pupils’ ideas a useful one that gave them feedback about these classroom activities. This enabled the student teachers to understand how participating in a research project on pupil attitudes enabled them to see how to facilitate the development of positive attitudes.

Representations of heroes

The research on stereotypes and attitudes towards children with learning difficulties was partly an exploration of self in a context of personal learning and development. For many participants, it was an opportunity to reconsider stereotyping different others negatively and to develop ethically positive ways of thinking and behaving – certainly this was the hope of the teachers involved. As an alternative, the research on heroes was a way to examine the positive personal worlds of children. This work was also an examination of both stages two and three of constructivism, as outlined above, as one concern of each of these studies of heroes was the heroes’ social dimensions. Was the hero an individual who excelled as an individual in a sport or a musical skill, for example, and who possessed characteristics such as beautiful, strong, or rich? Or was the hero a person valued for social reasons (kind, honest, or caring)? In one study (Gash & Conway 1997), teachers sought to promote prosocial heroes in classrooms, with some success. In each of these studies on heroes, contrasts could be drawn between the national social contexts of the heroes constructed by the Irish and Slovenian participants (Gash & Bajd 2005) and between those constructed by the French and Spanish children (Gash & Domínguez Rodriguez 2009).
Representations of learning in school

« 20 » Finally, two sets of studies examined the cognitive constructs or representations of pupils and teachers in different countries of their classroom life (Rault et al. 2001). The first set grew out of a decade of collaborative work on pupils in difficulty in schools. The initial focus of this work concerned ways teachers conceptualised school success and failure in Spain, France, and Ireland. A later collaboration on the same question also included teachers from Italy, Portugal, and Brazil and focussed on beginning teachers and ways they felt empowered or constrained in their dealings with pupils who experienced difficulties following the set curriculum. One of the aims of this latter study was to provide feedback to the teacher education institutions about the adequacy of their teacher preparation (Gash 2006). The studies also provided teachers with alternative ways from other countries of thinking about their work, which were useful in their professional development.

« 21 » The second set of studies were concerned with ways teachers and children thought about their educational practices in upper primary and lower secondary schools. This European project was designed to enable and facilitate constructivist science education because in the countries involved this was deemed a priority (Robert et al. 2009). Questionnaires were used to enable the educational partners (teachers and pupils) to think about specific approaches involved as part of this process of self-reflection. The school participants worked in upper primary and lower secondary schools in France, Slovenia, the Czech Republic, Cyprus, and Ireland. Analysis of the data from the questionnaires showed differences in the importance of features of constructivist education, including learning about science and the world, learning to learn, learning to comment on the teaching process, and learning to communicate. Appreciating differences between ways teachers in one’s own country differ from teachers in other countries may offer opportunities for teacher self-reflection. Indeed, differences between any one teacher’s scores and those of other teachers in the same country can also do this. The Czech teachers sampled, for example, had significantly higher scores than the Irish teachers on two variables, learning about science and learning to speak out. The Irish teachers scored higher than the Czech teachers on the variable learning to communicate (Gash & Chocholouskova 2013). One limitation of this approach was that the questionnaire prescribed the dimensions of child and teacher thinking we investigated. However, the strength of the approach lay in the production of data for use in teacher development.

Exploring the teacher/learner interface

« 22 » Each of these school-based research studies mentioned above began with an image of teachers’ or pupils’ representations. The constructivist approach was simple, and consisted of using questionnaires to take a “picture” of the person’s ideas about some topic that interested the researchers. Throughout these studies, there is an underlying idea that a teacher’s function is to enable learning through providing enriched experience that will allow personal learning and development. Having a questionnaire is one way of looking at thinking and the results allow reflection and discussion with the participants. In the domain of communicative language teaching of a second language, Marie-Annick Gash (1988) studied the ways teachers might facilitate pupil language use. This involved taping a number of individual classes during the school year and examining the types of language used by the teachers and pupils. Transcribed text was analysed to reveal what types of discourse enabled pupil initiation. This study was designed to analyse the actual classroom processes to show what forms of language use facilitate more creative second language use in the learners.

« 23 » In the domain of digital learning, Deirdre Butler (2004) examined ways teachers could be helped to engage in constructivist or constructionist learning. This was a study that examined a number of features that might be significant in initiating a recursive paradigm shift in their teaching practices so that their classrooms became places where children worked more often in more constructionist ways. The children used LegoMindStorms materials and this meant that the teachers were unable to provide ready-made answers for the children’s questions. So teachers and pupils had to solve the problems together. In fact, often the children found the solutions and the teachers were guides and mentors rather than instructors. While this created a teaching context some teachers found difficult initially, it provided conditions that facilitated genuine change in the teachers’ approaches and enabled constructivist teaching. One telling example, which reflects the importance of the learner/experience interface mentioned above, is the teacher who said the most important way his teaching changed was by encouraging the boys to share ideas and critique each other’s work. In this way, he felt the boys could see how real designers worked as part of a community. Butler (2004) identified a number of principles to facilitate the emergence of constructivist learning environments in schools: immersion (to allow teachers to learn new approaches in an appropriate way); sustainability (so teachers were supported to engage with pupils over a number of years); and scalability (to spread the good ideas and widen the community so ideas did not wither.

Moving on

« 24 » In the studies that follow, the research approach is more dynamic and shows ways constructivist educational research has evolved. Where the research described above had focussed on representations and interventions to facilitate new ways about thinking about children who were different or in difficulty, or about heroes, or about teaching, the following studies are more concerned with dimensions of the teaching/learning interface, such as how small groups work, and how teachers manage uncertainty.

« 25 » The striking educational question to ask now is how to think about the teachers’ role in the 21st century. Books remained largely unchallenged as the source of information throughout the 20th century. There are indications that this is changing rapidly (Serres 2013) and students are increasingly disenchanted with traditional forms of education. For some time, and increasingly during the last decade, educational programmes have been designed that emphasised student...
Learning in small groups

A change in classroom dynamic is inevitable in collaborative learning. This is a change from the tradition where teachers talk and students listen. That worked well for some students in the past but not for all. One way to increase the amount of student engagement is to organise groups of students so that they work together. In a constructivist learning environment, students learn when the ideas they have about a topic are challenged and they have an opportunity to notice new ideas and construct more complex representations about the subject they are studying. There is no guarantee that this type of learning—learning will occur, so the instructor needs to take considerable care to ensure that the learning activities are challenging. In a review of how small groups work, Good, Mulry and McCaslin (1992) discussed small group work in relation to the following characteristics: active learning, opportunities for peer interaction, more interesting mathematics, enhanced opportunity for mathematical thinking, teacher as curriculum developer, inadequate curriculum, implementing new tasks, assigning student roles, student passivity, and accountability. Many of these characteristics relate to the design of constructivist learning conditions. Curriculum issues deserve some comment because teachers in Ireland sometimes use textbooks in ways that favour individual work, for example by asking the whole class to do the set exercises on a topic in maths. This allows the teacher to work with individual children in a supportive way. Clearly, it is the cooperative element in group work that will facilitate the development of social skills. In their review, teachers were often left to their own creativity in developing suitable tasks for the students (Good, Mulry & McCaslin 1992). This is overcome in approaches using lesson study.¹

Bernadette Dwyer (2010) emphasises the balance between teacher intervention, pupil learning, and pupil involvement in organising cooperative learning. This study of student learning used online and other digital resources in a variety of classes, including reading science and social studies. The aim of the study was to examine classroom behaviours as students and teachers learned to use online resources effectively in groups. Students were observed extensively and interviewed about their learning experiences. Results showed that the role of the teacher changed over time, with scaffolding decreasing and responsibility being given increasingly to the students. Essentially, teachers became co-learners with the students as the year progressed. That is, the teachers facilitated online learning and the pupils increasingly relied on each other as partners.

Data analysis showed that peer collaboration led to social construction of knowledge in ways that were facilitated by emerging student behaviours during the year. The students were constructing knowledge in groups. This learning was facilitated by the ways that the students related with each other. There were four themes: peers offered support to the group members, they asked questions that led to refinement and differentiation of ideas, they helped each other to stay on task and to be efficient in their work, and they developed ways of talking about the task that included showing as well as talking because words can sometimes obscure meaning. Support was helped by assigning specific roles to the group members.

¹ Cf. the Lesson Study Project of Bill Cerbin and Bryan Kopp, http://www.uwlax.edu/sotl/lsp/

Students learning together

In a study that could serve as a model for investigating constructive cooperative learning using third-level students, Dolores Corcoran (2008) studied collaborative learning amongst student teachers planning cooperatively to teach mathematics in Irish primary schools using the lesson study method. Mathematics in Ireland is largely thought about at the second level, as memorization of formulae and procedures. Given that teachers are likely to begin teaching using the techniques they have experienced, it was hoped that the opportunity to work together collaboratively to prepare these lessons would provide an opportunity for these student teachers to appreciate how to work in this way with their pupils in primary schools. The Irish Primary Curriculum is explicitly constructivist, although there is an over-reliance on textbooks in various subjects, including maths, contradicting the spirit of this philosophy.

Corcoran (2008) initially gave the student teachers a test of their mathematical ability. Next she observed a small group of participating students teaching and in the final part of her study she arranged for small groups of students to work together collaboratively in a lesson study exercise to plan their maths lessons for teaching in primary schools. The key dimensions of classroom teaching that she focussed on...
were specified in Tim Rowland and Fay Turner’s (2007) knowledge quartet: foundation, transformation, connection, and contingency. While Corcoran was concerned with mathematics teaching and learning in a constructivist context, the processes she described are fruitful for thinking about collaborative pedagogical practices in other domains of knowledge. Foundation is the basic understanding of the subject matter. Transformation is about the coherence of the sequence of lessons or lectures, and contingency is the capacity to cope with unexpected events in class – to deviate from the plan.

Analyzing students’ teaching using these categories provides significant and interesting insights into their actual teaching. While this assessment was done in the context of a PhD thesis in this case, it would be possible within a staff development initiative at third level to use similar procedures using video recordings of lectures. It may be that the knowledge quartet categories used above would change in response to needs noticed in the analysis of the lectures. However, the following will give a more precise idea of the sorts of insights into the teaching process gained from the categories described above.

In the analysis of the students’ teaching, in some cases the children were clearly working on problems but it was not clear that these were problems that were socially relevant, rather they were text-book based. In this sense, they were probably not facilitating meaning making as is recommended by constructivist practice. Some student teachers taught by telling, others by questioning, prompting, and encouraging children to reason about the material. Some student teachers provided more structure to the lessons but others were more concerned to provide actual working experience in groups. Overall, student teachers used different organisational strategies: some were very clear but constrained by the topic and less concerned with the activities that the class were engaged in, and others, in contrast, were concerned with providing engaging group activities and less concerned with the overall presentation of set materials. It seems that a critical issue is whether recall or understanding is prioritised, and reflection on the activities is needed to promote the type of constructivist teaching that is presented in the curriculum.

Having observed the student teachers teaching, the next step in helping this group of students reflect on constructivist practice was to implement the lesson study approach in a collaborative way. The students prepared lessons that they would teach in primary schools. Through watching videos of these lessons being taught, the students became aware of the significance of their mathematical strengths and weaknesses and how important it was to connect the lesson with the pupils’ other experiences of the material. Also, they experienced examples of work that emerged contingent on pupil comments to the ongoing activities. This was the first time they had an opportunity for others to observe what they did. As the lesson study process continued, engagement improved substantially and the students spent more and more time doing the activities and concentrating on the maths and how to teach it best. The role of the researcher changed and issues of how the group controlled itself were part of the process too.

As the student teachers worked in this way collaboratively, their engagement and their alignment with the group contributed to developments in the identity that they constructed by participation in this community of practice. They found lesson study was a way to break the tendency to teach the way they had been taught. The preparation of lessons, their delivery and then the group reflection on how they worked enabled change and helped them to be more comfortable with their uncertainties with their teaching. Group collaboration became a way of appreciating how they could develop as teachers in their careers.

Finally, Corcoran (2008) considered the viability of facilitating the introduction of this type of approach in schools. She noticed that some teachers felt it would be hard to put in place; however, it has been put in place in England. As a model of educational practice, it seems that it would require support at the school level and even at the school system level. I will return to this issue in the next section of the chapter.

The importance of being uncertain

Where Corcoran (2008) provided a model of cooperative learning at the third level for use with students, it remains important to keep attention focussed on the pupils’ engagement in their learning. Therèse Dooley (2010) recently completed a study illustrating how to achieve this by focussing on moments of uncertainty in pupils. She examined how lecturers and teachers can facilitate the emergence of new ideas by looking at conversations in class. She began by specifying the constructs that she hoped the pupils would develop by engaging with the class materials. Central to this work is the recognition that what is important is the construction of new ideas for students and additionally that this construction is a delicate process. It is about the emergence of new ideas, and it is a delicate event that needs sensitivity from the teacher. Dooley identified three aspects of this process of construction for teachers to focus on: epistemic actions, hedges and pronouns, and teacher follow-up moves. The epistemic actions were recognizing, building, and constructing by the learner (Hershkowitz, Schwartz & Dreyfus 2001). The hedges and pronouns were the signals the learners were puzzled. So they used pronouns such as “it” to refer to symbols such as square roots, indicating they had an idea that was uncertain but was part of the emerging meaning structure. Similarly saying “maybe,” “I think,” or “possibly” was an indication that pupils were wondering how to sort the intuitive ideas in their heads to allow the ideas to emerge (Rowland 1992, 1995).

Teachers need to develop a set of procedures where conjectural ideas are fostered and where students are not afraid to be wrong but are encouraged to work with their uncertainty. Key teacher tactics here are prompting and scaffoldings and supports that teachers give to students as they come to terms with ideas that are uncertain and just emerging in their thinking. These uncertain ideas are ones that seem important to the teacher but that the learners do not recognise as such. These are the “almost there” ideas. It is also important for teachers to add to the learner’s contribution (e.g., elaborating, suggesting, correcting); to elicit
something from a learner (e.g., who has a good idea that needs to be drawn out); to press or encourage the learner to say more about the idea to allow its emergence; to confirm – where the teacher wanted to be sure she had heard correctly. Indeed, Dooley admitted she was initially uncomfortable repeating statements made by students as she considered this bad educational practice, whereas later she recognised that “revoicing” provided the support needed to help student intuitions develop into newly constructed ideas. A critical issue in the teacher’s role in fostering the construction of new ideas was what Dooley (2010) referred to as the “conjunctural attitude,” that is, the way the uncertainty was nurtured to allow the emergence of new ideas (Mason 2008). Such conjectural thought was necessary to allow the ideas to be public, to sift through them socially to see what worked and what was of value.

Dooley (2010) found that constructing insight had embedded within it two other epistemic actions of “recognising,” and “building with” in the lessons she examined. She also noticed that in some productive lessons the group shared these activities. It was as though when the group had a common purpose, more group members took on supportive functions for the emergence of new constructions. Dooley found that often when pupils constructed ideas in pairs, or when working in small groups, the ideas fed into the plenary discussion at the end of class. So the extended whole class discussion could be a powerful vehicle for consolidating insights. In the recent past, the importance of constructivist educational practices has been extensively debated in relation to mathematics education (Tobias & Duffy 2009). One side in this debate has focused on the importance of direct instruction and the other on the values and benefits of constructivist approaches (Gash 2009). The case for the social benefits of the constructivist approach was robustly made by (Gresalfi & Lester 2009), who emphasised the importance to the class of participating in particular practices in a social system. Such a dynamic learning process facilitates opportunities for discovery in ways consistent with RC, as also shown by Butler (2004).

Professional development for the constructivist teacher

Eithne Kennedy (2008) completed a landmark study on teacher professional development designed to improve poor reading standards in a disadvantaged school in Dublin. The study received an outstanding dissertation award in 2010 from the International Reading Association. It is interesting here because it moves the discussion from maths teaching to reading and highlights key features of the process of teacher development, earlier emphasised in Deirdre Butler’s work (2004). The aim here was to improve literacy achievement by finding ways to engage the children in their reading and writing. A key element in her strategy was to work with the teachers in the school, effectively forming a collaborative teacher network. Like other research reported here, it stresses the importance of the whole school approach, of collaboration with external partners who may provide models of good practice, of being grounded in the content of teaching. In addition, it is based on constructivist teaching principles, and focuses on improved achievement for students. The teachers participated in workshops designed to teach them about teaching reading. They perceived a variety of changes in children that occurred after these experiences, including higher levels of engagement in literacy, achieving key reading skills, and becoming strategic, thoughtful readers. The study ensured engagement by designing a learning environment where meaning is socially constructed through collaborative learning in the pupils and where enthusiasm for writing throughout the study and illustrates how the social side of learning is important. Turning to the effects of the change process on the teachers themselves, teachers reported feeling they knew more about teaching the subject matter, they felt they were doing a better job, they felt they had developed a more profound interest in teaching literacy, and they felt valued for their knowledge and experience. An important aspect of Kennedy’s work is the idea of sustaining change through the development of a learning community. School change depends on building a community of practice so participants can share expertise. This requires creating organisational support in the school.2

Hugh Gash obtained his doctorate at State University at Buffalo in 1974 with a thesis on moral judgment. He was a post-doctoral researcher at the University of Georgia with Charles Smock and then worked at St Patrick’s College Dublin until 2010. Gash is a member of the International Institute for Advanced Studies in Systems Research and Cybernetics. He has published extensively on educational applications of constructivism, with a particular interest in changing attitudes and children’s representations of different others. He met Ernst von Glasersfeld in 1973 at the University of Georgia. Ernst’s thinking had a major influence on Hugh’s work, details of which may be found on his website, http://staff.spd.dcu.ie/gashh/

http://www.univie.ac.at/constructivism/journal/9/3/302.gash
In Irish schools, as in universities across the world, it is a challenge to find the time to collaborate and plan collectively and to reflect on the work done. However, to sustain change and to empower the teachers in their work, collective planning is essential. An element in this is the need to nurture trust. Teachers need to feel comfortable sharing their work. The final two aspects of the professional learning community that Kennedy emphasises are capacity building and having a research stance. Leadership in learning communities must allow participants to be empowered through sharing power, authority and decision making. The teachers found the professional readings and the video demonstrations of others working very helpful. It is important to share the positive results of constructivist studies because in today’s accountability culture their successes become obscured in the search for narrow gains in “objective” test scores.

Conclusion

Constructivism provides a model emphasising the importance of the interface between individual and experience. This paper has surveyed some constructivist research with educational implications and began with studies designed to clarify what RC meant and how individuals construct different personal meanings for various educationally pertinent concepts. Understanding these differences is important for teachers so that communication is based on the learners’ varying ideas. In this interaction, RC invites appreciation of difference, and it is about balance between systems and respect for difference between systems. Constructivism emerged as a way of modelling cognitive processes that recognised the paramount role of the learner and the learner’s agency at a time when older models focussed on externals such as behavioural objectives. In the second half of the paper, research was described showing ways teachers may engage with children and facilitate emergence of new ideas, for example, by showing respect and by facilitating uncertainty. Getting the balance right for agency to function – whether it is for the individual learner or inventor, or the teacher working with students, or the institution’s administration – all have their parallels. Understanding how to sustain and facilitate change and sustainable development are central not just to schools but to all sorts of institutions. Trust and mutual respect are elements in this, but an emphasis on process is central because what is beyond ourselves is inevitably mysterious. Constructivism as a systemic approach provides a framework to discuss forms of living and their emergence, whatever the domain.

Open Peer Commentaries on Hugh Gash’s “Constructing Constructivism”

Radical Constructivism: A Theory of Individual and Collective Change?
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> Upshot • Gash’s retrospective analysis suggests a number of different roles for RC over the past thirty years. We outline three of these roles and then conduct a thought experiment to argue that while RC itself could be seen as a living theory that accommodates new ideas, its strongest contributions remain when it stays true to its roots and serves as a milestone along the path of educational paradigm shifts.

> 1 • Gash (§3) lays out five basic assumptions that shall be taken as shared. The pivotal idea, based on Ernst von Glasersfeld’s (1995b) interpretation of Jean Piaget’s work, is that learning (or what we might call changes in learners’ perspectives) is a cyclic process that emerges over time. We use this idea to conduct a thought experiment in order to consider Gash’s proposition that RC itself can be seen as emerging in stages. We begin our experiment by exploring the idea of stages in terms of ways that the collective culture of educational researchers has adapted the tenets of RC to fit with new experiences and the more socially-oriented ideas that have arisen over the past fifty years. Would constructivism itself then be re-shaped but still remain true to its principles? In what follows we trace three roles that Gash describes, and wrestle with the question of whether RC has changed or whether it should remain intact so that lines can be drawn to distinguish assumptions of new paradigms that fundamentally conflict with those of previous ones.
Role 1: RC as a frame for conceptual change

« 2 » Applying this thought experiment to Gash’s article, we begin where he begins: a review of his own interpretation of the tenets of constructivism used to frame students’ changing views of themselves and others. As Gash notes, “Throughout these studies, there is an underlying idea that a teacher’s function is to enable learning through providing enriched experience that will allow personal learning and development” (§22). We found this review of RC to be quite interesting and novel, given that most RC-based studies with which we were familiar tended to be more tightly focused on specific changes in students’ schemas for conceptualizing mathematical relationships such as counting of numbers as composite units of 1 or 10 (cf. Steffe, Cobb & Glaserfeld 1988), or rate as a composite unit of time and distance (Thompson 1994). Using RC to characterize students’ views of themselves and their stereotypes of others as transient, early conservations was therefore a refreshingly new idea that, as Gash states, had a profound influence on a great number of teachers and school systems confronting social ideas of prejudice. In summary, Gash describes the role of constructivism in the first half of the target article as a theoretical lens for hypothesizing the internal mechanisms that brought about changes in students’ personal learning and development” (§22).

Role 2: RC as a theory of pedagogy and instructional design

« 3 » A second role (although Gash does not designate this as a new “stage”) for RC appears in Gash’s repeated references to “constructivist teaching” (§§10, 17, 23, 33, 40), “constructivist practice” (§§26, 33, 34), and “constructivist curricula” (§§30, 33). Some have argued that this is a so-called “category error” (cf. Cobb 2002; Cobb & Bowers 1999) because a theoretical perspective on the nature of knowledge cannot provide prescriptions for pedagogy (cf. Confrey 1995; Simon, 1995; Sfard et al. 1998). The question of whether a theory that makes predictions about process should have implications for actions can be debated in numerous ways. On the one hand, a theory for cancer would do no good to a patient if it did not also suggest a path for a cure. On the other hand, if constructivism is interpreted as a prescriptive that instructors should not tell their students anything because they need to construct their own knowledge, then one could argue the opposite as well: RC theory suggests that even if instructors did tell their students what to construct (via direct instruction for example), it would not impact the knowledge they construct because they are in charge of making their own constructions.

« 4 » Gash’s view on the above-described debate is clear. He cites his review of Sigmund Tobias and Timothy Duffy’s (2009) book Constructivist Instruction: Success or Failure?, in which he indicates that he believes not only in constructivism as a pedagogy, but also as a well-developed process that can be effectively assessed (Gash 2009). It is important to note here that those of us who believe RC to be an epistemology do appreciate instructional designers’ vision of students discussing and debating ideas. In fact, this is consistent with current educational reform initiatives such as the Common Core State Standards (NGAC 2009). ‘The argument is simply that it is not within the purview of a theory of knowledge in general.

Role 3: RC as a socially-situated frame

« 5 » Gash describes a third “stage” of RC in his reviews of more recent studies in which the unit of analysis has shifted to students’ interactions with peers by stating that the focus is more “active” in nature, tending to take the teaching-learning process as the unit of analysis. Continuing with the thought experiment, we imagine the larger learning is seen as arising from participation in exchanges. As such, the unit of analysis is the mode of participation in action, not a survey result. While some could argue that the learning is still being constructed by the individual conversant, the unit of analysis is now the collective, normative aspects of acting, and learning is seen as the process by which individuals modify their participation in the collective. This claim, which seems to describe the latter studies, conflicts with one of the major assumptions of radical constructivism, which is that individuals modify their participation as posited by Gash, wherein “…ideas are always modified by ideas – it’s all internal” (§3).

http://www.univie.ac.at/constructivism/journal/9/3/302.gash
Radical Constructivism in Learning: Breaking the Tyranny of Information Accumulation

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> Upshot • Radical constructivism is explicitly discussed in Gash’s target article outlining “stages” or types of constructivism. The stages contextualize radical constructivism in a series of research phases involving a number of domains using a variety of approaches. The target article begs the query: “Just how radical are many constructivist approaches in teaching and learning?”

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4 The current scientific view is that neither genetics nor environment are solely responsible for producing individual variation, and that virtually all traits show gene–environment interaction (Ridley 2003; Hunter 2005; Rutter 2006). The changeability of scientific knowledge, and thus its understanding and focus, reflects very well von Glasersfeld’s ideas on RC and should open up a more collaborative, interactive, if not humble approach to scientific knowledge.

5 Hugh Gash (§§3–10) discusses stages of constructivist thinking as a series of ideas that build on Piaget’s assumptions. The fundamental primitive, which could view these stages as corollaries of Piaget’s theories rather than actual stages that one moves through, is Piaget’s (1954) idea of “auto-organisation,” which is related to the biological term “teleonomy” (de Laguna 1962, though first coined by Pittendrigh 1958). Auto-organisation is a process going far beyond growth and development – whether limbs, organs or cognitive structures – and comprises more than linear commands from a central controller. “Strong dynamic non-linearity” is furthermore a key feature of “self-organization.” However, self-organization as a biological concept (Bonabeau, Dorigo & Theraulaz 1999) may or may not involve feedback mechanisms, whereas auto-organization as a model of mental development does. The organisation of any aspect of human development is time critical (and thus a temporally constrained “stage” of development is a pertinent idea) in terms of biochemical activity coupled with neuronal activity (McEwan 2004). Relevant to auto-organisation is the concept of “self-regulation” (Bell & Deater-Deckard 2007), which is a way for an individual to assert control over the conceptualization they are constructing, or resist attempts to change it. The stages discussed by Gash (§§2–10) are summed up by Piaget’s (1954) assertion that “intelligence” (within the organism) organizes the world (the environment) “by organising itself” (hence: “auto” or “self”). This is again akin to self-organization, which is where “order” (within the mind of the individual) arises out of local “interactions” (between the individuals and their environment): this process can be directed mostly within the individual by changes to the environment (Ashby 1947). The first three elements (§§) involve the child attempting to resolve differences between their experience of the physical and social environment and others’ experience. The child must do this themselves, although adults do intervene, unfortunately not always in a helpful way. Thus self-organization is pertinent here too. Gash (§6) sees two further aspects, namely, “the circular nature of thinking” and “recognition of the limits on what is known” as hallmarks of RC, and these are reflected in elements 4 and 5. These are of course, a re-invention of von Glasersfeld’s two tenets of RC. However, one must ensure that “the circular nature of thinking” is not merely reduced to rote learning or “drilling.” Rather, “circular thinking” implies a recursive/reflective process involving feedback loops, which is part of auto-organisation as well as types of self-organization. What is interesting about “recognition of the limits on what is known” is that not only is there such a limitation in the general sense, but a child holds their own especial limitation on what they can know. It is therefore crucial for the teacher to determine where this rests at that time rather than assume so-and-so cannot know such-and-such or determine that certain work is appropriate for her class (“it was written for their age”) when it is patently too simplistic. Gash finally states “it is so important not to have fixed ideas about reality” (§7), which is a radical constructivist standpoint. It relates to “recognition of limits on what is known” (§7), including what we think we know about others. However, as external experience inflates through time, internal representation must organize itself (i.e., self-organize) to meet it. Internal representations must make some account of it in the mental frameworks of the individual. Therefore, learning (and teaching) must take a “bottom-up” approach that facilitates “circular thinking” and “recognizes the limits on what is known” in instructional and curricular design (Harri-Augstein & Thomas 1983).

6 A number of projects in a variety of domains are reviewed in Gash’s paper (§§12–41) and they do strive to adhere to the constructivist paradigm. Each of the projects is focused in a highly specific domain and the constructivist approach is different in each. However, there is a general theme that emphasizes the social construction and collaborative approaches to learning. A re-evaluation of the prefix “radical” to constructivism is needed in each of these projects. A somewhat superficial implementation in the anglophone world (e.g., New Zealand, viz., Bell 1991) in the 1990s led to constructivism being subjected to severe criticism (Mathews 1993, 1994, 1995). This has resulted in constructivists being on the defensive (Gill-Pérez et al. 2002), especially the radical constructivists in education. The “radical” of RC needs to be re-emphasised, and the greater the radicalness of constructivism, the greater the benefits that may be accrued in the learning context. To suggest a few:

1 the distinction between learner/novice and teacher/expert becomes blurred – there is a loss of the them/us distinction, leading to a greater democratization of learning (in contrast to the view that “children possess inferior knowledge” (§6) and their conceptions are only “misconceptions.” In non-RC teaching, teachers continue to pretend they know everything, when children know better; in RC teaching, freedom becomes a requirement to enable learning, rather than a privilege.)

2 the acquisition and development of finite factual knowledge over skills, process and capabilities is rendered a null activity (otherwise subject knowledge takes primacy over the individual person; in contrast, all the studies outlined by Gash are centred on the learner.)

3 scientific innovation results from the recognition of a variety of methods and drawing on many subject areas – lateral thinking trumps a single scientific methodology and a finite set of facts, and as a result, there is less need to be trapped within narrow subject boundaries. (Gash §§12–41 explores areas such as “gender stereotypes” (§§12f), “learning disabilities” (§§14–18) and various domains of representation (§§19–21), which prompts an overall scientific inquiry into RC.)

The projects, therefore, certainly approach von Glasersfeld’s second tenet in their conceptualization. However, the challenge for

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teacher educators and educational research in general is to pass the RC baton to the teachers themselves, who have formerly been those who have held fixed views and seen their role as “information providers.”

Conclusion

* 7 * All this is very well, but as Gash reminds us, there is a “stickiness” (§1) or resilience to the notions of information transmission and the permanence of information despite the probabilistic nature of many of life’s issues. In ancient Ireland, to qualify as a court poet, a man had to be able to recite about 1000 poems (cf. Book of Leinster), 2 but did not necessarily compose any. There is a sense that today those young people who can acquire huge quantities of information are lauded, and all the rest—though many are no less intelligent, compassionate, moral and human—are prevented from having professional careers on that basis. I prefer the term “tyranny of information” to describe the over-arching dominance of information. So what constructivism must not be is a mere set of “tricks” to assist teachers to help children acquire more facts through memory-enhancing tricks, whether in (i) the affective domain (i.e., using constructivism for motivation/self-esteem), (ii) short/long-term memory manipulation (i.e., using constructivism for improved memory storage) or (iii) knowledge structuralisation frameworks such as mind/concept maps (i.e., using constructivism for improved mental frameworks), to list a few. And yet these approaches can be radical if the educator moves to von Glasersfeld’s epistemological tenets. At least the court poets in ancient Ireland could be sure to have an audience when they recited their poetry.

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1. The Book of Leinster (ca. 1160; Lebar na Níáchonghála, TCD MS H 2.18; cat. 1339) was an accumulation of many materials, one of which specified the poems to be recited by a court poet, his rights and privileges.

2. The concept of “constructivist teaching” seems unattainable for two reasons: a philosophical and an empirical one. Also, Hugh Gash’s survey is not so much about radical constructivism in education, but a review of different connected ideas labeled “constructivism” that have dominated the educational field.

> Upshot • The concept of “constructivist teaching” seems unattainable for two reasons: a philosophical and an empirical one. Also, Hugh Gash’s survey is not so much about radical constructivism in education, but a review of different connected ideas labeled “constructivism” that have dominated the educational field.

> 1 * I am doubtful of the idea of different stages in the development of RC in Hugh Gash’s target article. To me it is more a question of different discourses. There is not one discourse of RC, but many. The differences may be due to differences in language and culture; sometimes to different scientific domains. Ernst von Glasersfeld, for instance, wrote for readers in different languages, in different cultures, and in different scientific domains. Most of my early readings on RC were written in German and in domains different from my own, such as philosophy, sociology, and communication theory. The discourse on RC that evolved in the German speaking culture is, in some parts, not only different from the discourse that evolved in English speaking cultures, but it became the dominant theoretical discourse in many domains here.

> 2 * I argue that it can be questioned whether there is something that could be labeled “(radical) constructivist teaching” for two reasons: a philosophical one and an empirical one.

> 3 * Philosophically, RC is an epistemological position and a theory of learning, not teaching. Nel Noddings (1990) even suggested that (radical) constructivism was not a strong epistemological position despite its adherents’ claims. It might best be offered as a post-epistemological perspective. According to Noddings, the standard questions of epistemology cannot be answered from this perspective. (Ernst von Glasersfeld appreciated this characterization, cf. Glasersfeld 1992: 20). One should not conflate epistemological issues and psychological (or educational) ones. There is an interesting parallel to the reception of Piaget’s theories in the English speaking world. Jean Piaget is here recognized for his work on child psychology and probably no one affected developmental psychology more than Piaget. He was of course pleased, but also very critical about the way he was understood (Bringuier 1980). His research program represents a unique way of integrating epistemology and empirical research. Psychologists have generally ignored his epistemology, the theoretical framework, whereas philosophers have dismissed the relevance of Piaget’s empirical research for epistemological issues (Müller, Carpendale & Smith 2009: 2; Chapman 1988).

> 4 * Empirically, constructivism has not only influenced, but also dominated education for a long time. But the label “constructivism” includes a wide range of loosely connected ideas, sometimes described as an umbrella for different theories and positions, of which RC is one (cf. Larochelle, Bednarz & Garrison 1998; Davis & Sumara 2002; Confrey & Kazak 2006). Many of the ideas of new ways of teaching that have become popular and that most people associate with constructivism, some of them described in Gash’s target article, do not originate from constructivist theories. Jerome Bruner’s proceedings (1960) from a conference in Woods Hole in the US in September 1959 was the start of a reform movement in science and mathematics education, not only in the US, but also in many Western countries. The movement included large educational projects such as Science Curriculum Improvement Study in the US, Concepts in Secondary Science and Mathematics in the UK, and the New Math reform in most Western countries. The projects aimed at inducting students into the world of scientists. But the teaching ideas were actually not new; many of them belonged to progressive educators from the beginning of the last century, such as John Dewey and William H. Kilpatrick (the project method). Many countries in Europe had their own reform movement (in German, Reformpädagogik), with reformers such as Maria Montessori, Friedrich Fröbel, Peter Petersen, and Célestin Freinet, with its roots in John Amos Comenius, Jean-Jacques Rousseau, and Johan Pestalozzi. New Edu...
RC is a Theory of Learning, not Teaching. Arne Engström

cation Fellowship, founded in 1921, was the international organization for these reform movements, with a biennale conference (from 1923 to 1932) with many well-known participants, amongst others, Martin Buber, John Dewey, and Jean Piaget. So what is often called “constructivist teaching” is mainly a collection of different ideas originating from the progressive movement in the US and the Reformpädagogik movement in Europe.

1. The impact Piaget’s theories had on the reform movement was tremendous. A special interpretation of Piaget focusing on his theory of stages in cognitive development evolved in the US and influenced many other countries. Gash seems to have been part of this movement. The “training studies” that Gash and many other scientists conducted were an expression of this interpretation. Later, Piaget’s theory became the target of many critics. As stated by Orlando Lourenço and Armando Machado (1996), some criticisms derived from widespread misinterpretations of Piaget’s theory. During my own research studies in the late 1980s I started to re-read Piaget after reading von Glasersfeld’s interpretation of Piaget. My interest was in his systemic thinking, with concepts such as equilibration, self-organization, and reflecting abstraction.

2. Gash has been working for a long time in science education, whereas I have been working in mathematics education. This difference is important. There is a fundamental difference between teaching mathematics and teaching science, for instance a subject such as biology. When a teacher in biology demonstrates something on a real plant he/she is trying to teach something about plants. A teacher in mathematics who demonstrates a concept on real objects does not intend to deal with real objects, but tries to communicate a mental construction that is not “identical” with anything in the experiential world. In biology a picture of a tree is an iconic model of real trees, whereas in mathematics teaching a triangle drawn on the board is a model of an abstract idea. Similarly, von Glasersfeld illustrates this with “the idea of equilateral triangle”.

3. You know and the class knows what you are talking about. You have in mind a structure that is made up of three perfectly straight lines whose length is exactly the same. Such a structure exists nowhere, except in our heads.” (Glasersfeld 1995a: 10)

In mathematics learning, abstraction is an essential feature. It is a constructive and an intentional process and depends on reflection. A customary distinction of mathematical knowledge is between procedural and conceptual aspects. Piaget made a distinction between doing something (réussir) and the understanding of it (comprendre). Between these two aspects there is a reflecting process (pris de conscience), which involves our conscious conceptualization, an attainment of consciousness by reflecting abstraction.

An educational theory of the development of understanding in mathematics must include some notions of knowing levels (see, for instance, Campbell & Bickhard 1986). Piaget’s theory does and RC does, but theories based on information-processing approaches and many non-Piagetian accounts do not. They are therefore insufficient for this purpose.

4. RC during the 1980s and 1990s became a natural point of reference in education. But this also involved extensive criticism from proponents of other forms of constructivism (social constructivism and later social cultural theory). One of the most common objections was that of RC being solipsistic and lacking a theory of social interaction, the view of the child as a solitary knower. This is the third stage of Gash’s idea. This criticism regarding RC was the same as that raised against Piaget – in both cases this criticism is flawed.

5. In his early works Piaget considered social interaction to be the main factor responsible for the transition from egocentric to socialized thinking and gave a purely social explanation of cognitive structures (Lourenço & Machado 1996). When Harvard University celebrated its 300th Anniversary in 1936, Piaget was part of a group of leading scientists that were given an honorary doctorate. He was then recognized as a sociologist: “He sees the development of children’s concepts upon a background of sociology” (Hsueh 2004). Between 1939 and 1951 Piaget held a chair in sociology at the University of Geneva. His Études sociologiques (1965), a collection of essays written from the 1940s and onward, was not available in English until 30 years later (1995). Here he outlaid a theory of social exchange. Michael Chapman (1986) stressed the similarities of Piaget’s sociological theory with Jürgen Habermas’ theory of communicative action (Habermas 1981).

6. It is obvious that the theories of Piaget have influenced RC in many ways. For example, they share the same epistemological concern. Although von Glasersfeld states that his position fits Piaget’s, it can be argued that RC and Piagetian constructivism are not the same and therefore it is incorrect to label Piaget as an RC. This claim is not new (e.g., Bickhard 1995; Smith 1999; Davis & Sumara 2002). I think it is a question of ontology; in the philosophy of mathematics it concerns mathematical certainty (Hersh 2008). According to Immanuel Kant (1787: B14–17), necessity and universality are sure criteria of a priori knowledge. Mathematical propositions are not just true or false, they are necessarily true or false. 2 + 5 = 7 is true, as well as “a week has seven days.” But contrary to the latter, which is arbitrary, the former statement is a necessary truth; it is a logical necessity. As discussed by Les Smith (1993), necessary knowledge is universal. The knowledge is not a personal possession of that person who has acquired it; anyone can, in principle, acquire and possess it. Necessary knowledge is self-identical. It is the same knowledge that is acquired by all of those who have acquired it. Necessary knowledge is not due to the contingent fact that a person has acquired such knowledge in the actual world. Necessary knowledge is the knowledge of necessary truth, which is true in all possible worlds. This should not be confused with Platonism, as stressed by Smith (1993), where necessity is an abstract object awaiting discovery. In a constructivist sense, necessity is a rational invention arising from the use of human ability. 2 + 5 = 7 is as true for a Brazilian street boy as for a Swedish middle-class girl. If a child believes that 2 + 5 = 9, he or she does not have the task of checking out this truth against some mysterious reality or relying on authority, but of constructing a self-consistent body of knowledge. But the social and cultural circumstances under which this body of knowledge is constructed are different. This is an educational issue, which must be dealt by the teacher in a school setting.

3] I owe this example to Damerow (1996).
Referring on Constructing Constructivism

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> Upshot • Hugh Gash’s paper on constructing constructivism is inspiring, insightful, and important in many respects. However, and for that reason, I want to reflect on some critical aspects in terms of metaphorical uses of expressions and ongoing processes of mediatisation and digitalisation. Lastly, I am going to point out critical potentials of constructivist thinking as related to education.

1 The title of Hugh Gash’s target article, “Constructing constructivism,” is challenging in at least two respects. First of all, knowing about the theme of the special issue on the “Forty Years of Radical Constructivism in Educational Research” is crucial in this case. Otherwise it would suggest a claim to not only a meta-analysis of RC as it relates to education, but to constructivism in general. Of course, the abstract dismantles such ideas promptly, at the same time generating curiosity about the paper. However, there remains another challenge that is related to the phrase constructing constructivism. Although selection criteria are not explicitly mentioned at the beginning, the selective survey points to both relevant conceptual considerations and exemplary educational applications. In so doing, and by way of connecting conceptual considerations and educational applications, the author’s understanding of constructivism as well as his selection of fields of educational research and profession development becomes clear. Moreover, the target article is an important contribution to constructivist discourses as they relate to education from both historical and systematic perspectives and it illuminates results from empirical research and options for designing educational practices. While the target article brings together all of these aspects, it can be read not only in the sense of constructing but also in the sense of re- or de-constructing.

2 Kersten Reich has pointed out the importance of an interplay of three observer perspectives within constructivist thinking in educational research (Reich 2010: 118–145): 1 appreciating that knowledge is constructed; 2 re-constructing by acquiring a sense of time, cultural spaces, social worlds and symbolic forms, developing a sense of history of knowledge, and learning about motives of others, and 3 pointing out omissions, revealing or uncovering forgotten aspects, becoming aware of contingent dynamics, and knowing that things could be different as perspectives of de-constructing. Reich develops all of these perspectives with a view to symbolic dimensions, imaginary ones, and realities (ibid: 122–142). Although Gash does not explicitly distinguish between constructing and re- or de-constructing, all of these three aspects come together in the target article. In §3, for example, Gash explains constructivist thinking in terms of “a multi-layered set of concepts interpreted in a variety of ways by the communities of people who use the word.” Based on brief re-constructions of thoughts of others, he constructs his characterization in a way that does not exclude other options. To the contrary, with the expression “it involves a series of ideas, including the following” he indicates that additional or other accen- tuations could be argued. Similarly, Gash’s way of bringing the “social dimension into sharp focus” (§9) immediately suggests itself as a way of pointing out underestimated or sometimes forgotten aspects in radical-constructivist discourses.

3 In the section “Stages of constructivist thinking” (§§3f), the author describes three stages, namely 1 appreciating that knowledge is constructed; 2 recognizing that radical constructivism implies that there is no match possible between knowledge and reality; and 3 teasing out the ramifications of this counter-intuitive position in one’s social world (§4). The way Gash elaborates on these three stages in the paragraphs of this section is comprehensible, coherent, and plausible. The distinctions are always helpful, not least for didactical purposes. At first sight, one is tempted to agree when he says: “It can be argued that a description of the development of constructivist ideas applies both to the literature about constructivism and to ways individuals come to understand it” (ibid. §4). Having said that, there are counter-examples both in everyday life and in academic discourse. Who does not know at least one example of a break-up of a long-term relationship in which instability or disruption of the versatile social world acts as a starting point for doubts about knowing, reliability, and “reality,” leading to thoughts about one’s construction of knowledge? Moreover, development of constructivist thinking as related to education and educational studies has been described differently by, for example, Frieda Heyting (1997).


5 Cf. also my discussion of various concepts of constructivism in educational research (Hug 2011).
Basically, she distinguishes between three groups of versions:

1. Versions evolving around the principle of the primacy of theory in relation to empirical observations in the 1970s,
2. Versions referring to the realization principle and assumptions about the constitutive power of education as, for example, elaborated in Wolfgang Klaßki’s critical-constructive theory of education (Klaßki 1976), and

I think that we can learn a lot by way of contrasting such overviews and basic distinctions and thus develop both a deeper understanding of meanings of the expression “systemic-constructivist” in the field of tension between relatively concrete individual constructions and ethnomet hodological micro-perspectives on the one hand and abstract systems theoretical perspectives on the other.

But speaking of “stages” is also problematic. It suggests clarity, but it raises questions, too. Is it about a series of positions or stations one above the other? Is it about stages in the sense of phases of development about periods of time, arenas, or settings? Metaphorical uses of expressions such as “stage” call for explanation and also constructivist reflections (cf. Krippendorff 1993). The assumptions of the logics of developmental levels of constructivist thinking seem problematic. This argument counts for both logical approaches to developmental stages within constructivist thinking and forms of situating constructivism in other sets of “stages.” A well-known example of the latter is the widespread classification of the world of learning by distinguishing between behaviourism, cognitivism, and constructivism. As discussed in Hug (2010), this classification is problematic because it suggests thoroughness and tendencies of an evolution from the lower to the higher. Apart from difficulties with an umbrella concept of constructivist learning—summarizing various approaches related to different constructivist discourses—there are other difficulties. Every solid handbook on concepts, models, and theories of learning shows that the manifold of forms and important issues of learning is not entirely covered by a triunity of behaviourism, cognitivism, and constructivism. Such a triunity does not cover, for example, conscious or unconscious dimensions of learning, emotional learning, or learning of organizations, generations, or societies.

In §10 the author writes about a shift from the “teacher/child interface” to the “child/experience interface.” Furthermore, he elaborates on the “teacher/learner interface” and “learner/experience interface” (§§22f). While the corresponding descriptions provide valuable insights into empirical research and a first orientation for the reader, again, a concern comes up beyond the scope of the details described. How is the interface metaphor used in these cases? What does it elucidate, foreground, and show? How does it hide certain aspects and what could we learn from a metaphorical analysis in order to understand better both the projects described and possible relations to other endeavors in collaborative and cooperative learning, enhancing experiential spaces, and professional development that do not refer to constructivist ideas and concepts?

I can agree on the claim that “children today live in a digital age” (§26). At least, many of them do. And I also see a need for concepts and applications in order to understand and enable micro-perspectives of learning better (Hug 2012a). But apart from the use of digital resources (§28) and from media as tools for video demonstrations (§41), media largely seem to act as blind spots in the deliberations in the target article. Although I do not want to underestimate efforts to “improve literacy achievement by finding ways to engage the children in their reading and writing” and “engagement by designing a learning environment where meaning is socially constructed through collaborative learning in the pupils and where enthusiasm for writing throughout the study and illustrates how the social side of learning is important” (§40), I think we have to aim at reconsidering the role of literacies in view of ongoing processes of medialization and digitization. Moreover, there is a need for clarifications of relations of literacy, mathematics, oracy, and picturacy if we take markers such as “mediatic turn” or “digital turn” as not just academic marketing gags. And which approaches for the description and critical analysis of manifold interplays of modes of construction could do better than undogmatic, context-sensitive, and open-minded constructivist approaches?

In conclusion, I want to make some remarks on critical potentials of constructivist thinking as related to education. This thinking and, especially, systemic-constructivist pedagogy have been criticized as a tautologic and affirmative endeavor, as functionalist pragmatism in the service of neo-liberal developments, as ideological superstructure corresponding with an unleashed capitalism, etc. Such claims can be easily rebutted on the basis of deliberations presented in Gash’s target article. But there is more to it than that: constructing constructivism can also be associated with sound ing out options for designing spaces for education based on design theory (cf. Krippendorff 2006) that was not developed for educational purposes in the first place. Furthermore, it can be related to explorations in the area of tension between the active role of individuals, media, and algorithms, and also between action learning, action-oriented (media) pedagogy, and the inspiring world of media activism. And it can point up viable options between the ongoing bureaucratization of schooling and calls to “Build a School in the Cloud” at https://www.ted.com/talks/sugata_mitra_build_a_school_in_the_cloud. But why throw out the baby with the bathwater if the full critical potentials of constructivist thinking have not been exploited so far?

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6 These terms are used analogously to the term “literacy” – the basic argument is outlined in Hug (2012b).
Radical Constructivism and Social Justice: Educational Implications

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> Upshot • Gash describes some very interesting and exemplary work using RC-influenced research and practices. I worry that his third stage of a three-stage emergence of constructivist epistemology in the study of cognitive development is consistent with a distinction between focus on individual cognitive development and focus on knowledge not in the mind but in the group, inconsistent with RC. An alternative is given and the issue of an RC perspective on social justice is discussed.

1 In his target article “Constructing Constructivism,” Hugo Gash provides us with an important perspective on the influence of RC on research and practice in education. In §4 he suggests we might think in terms “of stages in the emergence of the constructivist epistemology.” This is one possible view, but I would like to suggest that the apparent distinction between the individual and the social, as it is typically made, is not consistent with RC.

2 In §29 Gash uses the phrase “social construction of knowledge.” Normally, in educational literature, it is used with a Vygotskian perspective. But Lev Vygotski was not RC and neither are his advocates now. (Dykstra 2009: 194–199) Yet in §10 Gash suggests:

**When a researcher emphasises the individual construction, the social side remains a part of the context; and alternatively, when the social context is emphasised, the individual interpretation plays a critical role.**

His §10 sounds more consistent with RC than his §29, but in §10 there is still the “social context” as distinguished from “individual construction” or “individual interpretation,” as if the “social context” is a kind of given for all while the individual constructions are personal. This is an example of how this language is not consistent with RC. Each of us has to construct our understandings of social contexts, just as we have to do so about why an object appears to move.

3 In §12–21 we find descriptions of research on students’ conceptions of others and the notion that students can change their conceptions of others. This is much more like RC. In this respect, Gash’s target article seems to pull the reader back and forth between a view that is RC and one that is not. It is not easy to free oneself from language that is not RC. This may be part of what is going on in Gash, but we are writing in a venue for trying to clarify our RC thinking for ourselves and others.

4 Jean Piaget was firmly against the notion that development was constituted of an accumulation of learnings. Instead, he maintained that each learning is a function of the current development of the individual (Piaget 1964: 171). In the Proceedings of the First Annual Symposium of the Jean Piaget Society, Piaget talks about the factors that influence development (Piaget 1972). To summarize, he indicates three classic factors that play a role in development: maturation, experience, and social interaction. However, he maintains that these three alone cannot explain development without a fourth factor, equilibration. Equilibration explains the changes that constitute psychological and cognitive development. There is a coordination between the first three factors that is a kind of dynamic equilibrium. In addition, in the construction of new cognitive operations, there is an iterative trial-and-error process, which uses the results of the previous trial to inform the generation of a new trial (Piaget 1972: 14). The results of a trial are anticipated on the basis of existing cognitive operations and models of the world. When the results are not what was anticipated, the trial has resulted in an error, which gives rise to speculative changes in the cognitive operations and/or models for a new trial. The search for a resolution to the disequilibration ultimately results in a new equilibrium, cognitive operations, and/or models of the world for which trials do not result in errors, at least for a while.

5 In his discussion of the experiential factor in development, Piaget suggests there are two kinds of experience (Piaget 1972: 7). One is the effect on our nervous systems by objects, and events involving objects, in the physical world. The other kind of experience is our manipulations of objects, in effect experiences of objects in the mind. A simple example is having a number of objects and choosing to line them up and count them. One might then decide to count them in the other direction. Lining the objects up, counting them, and then counting them in the opposite direction are not properties of the objects themselves. To line them up and count them are mental inventions, hence, experiences with objects of the mind.

6 Human beings are cognizing entities in a persons world. They are much more complex and much less passive than most physical objects in our constructed realities. However, just as with physical objects, we each must construct mental models of those around and important to us. One can argue that in the experiments Gash describes, students are engaged in constructing more effective models of other human beings. At one level this is no different than constructing a more effective mental model of a bicycle. However, with a bicycle, if one subjects it to a certain set of conditions, it will always behave a certain way, as will all bicycles made to be the same. Not so with human beings. They are so complex and subtle, it is virtually impossible to establish the same conditions twice.

7 Luckily, we can discern patterns in the behaviors of human beings. These patterns are our first foothold into making mental constructs to associate with other human beings. Culture has a powerful effect on the behavior of human beings, giving more footholds on making mental constructs to associate with those around us. Culture provides us with one more tool, language. Language gives us a very powerful tool for both giving and receiving feedback as we experience others. Language, and therefore culture, also has effects on how we think as we are mentally constructing our models of the world around us.

8 The stances of both Piaget and Glaserfeld with respect to our fellow human beings are to treat all as epistemic entities. We acknowledge that each of us bears the responsibility to make the most effective constructions of our worlds, but that these constructions will not necessarily all be the same as our own. We know that, apparently,
some have started more recently than us and others seem to have stopped their con-
structions of their worlds.\footnote{7} In both cases, language is the tool for interaction, engag-
ing others in continuing in or getting back to the construction process. This respect for
others as epistemic beings is a fundamental
element of social justice as the practice of
and an outcome of RC.

\footnote{8} It can be argued that we have three kinds of experience: physical, mental, and
social. We could argue that there is some kind of hierarchy composed of these three
types of experience, temporal or of com-
plicity, but such arguments are probably
neither productive nor solvable. It is appar-
ent that school and culture should engage
students in constructing ever more effec-
tive reasoning patterns and models of how
the world (including other human beings)
works. \textit{But, is this what is happening?}

\footnote{9} Unfortunately, we have known
that schooling is not engaging students in
constructing more powerful reasoning pat-
terns and constructions of the world since
at least the 1970s. When the work of Piaget
and his colleagues was introduced into sci-
ence education in the US, people started try-
ing to assess the stages in the development of
reasoning in their students. Early on this
was done using interviews modelled after
those of Piaget and using paper-and-pencil
puzzles, which grew out of the kinds of tasks
Piaget’s group were using. In the mid-1970s
it appeared that about 1/3 of people were
still displaying reasoning at the level of con-
crete operations, about 1/3 were displaying reasoning at the level of formal
operations, and the remaining 1/3 were sometimes
displaying concrete operations when for-
amal operations were appropriate and other
times displaying formal operations. It also
was documented that these proportions did
not appear to change in in any significant
way from the ages of about 13 to 45 (Arons
& Karplus 1976: 396). Clearly, schooling
through college and culture were not result-
ing in further increases in the proportion
displaying formal operations. Yet it is pos-
able for human beings to have developed formal operations by the age of 18. There
is no evidence that this situation is different
today.

\footnote{10} At the same time, physicists read-
ing the work of Piaget and his group noticed
in the interview transcripts that not only
could one see evidence of the reasoning the
subjects were doing, but one could also see
evidence of how the subjects thought the
phenomenon in the interview task worked.
This gave rise to a large quantity of work
investigating students’ conceptions of the
phenomena studied in physics and other
science classes. Two important findings of
this work are:

1. Students come to class with strongly
held conceptions of the phenomena that
do not match what their instructors are
telling them.

2. Standard instruction results in no real
change in the students’ conceptions of
the phenomena.

Schooling appears to have no effect on either
development of reasoning or on students’
understanding of the phenomena.

\footnote{11} One can ask why this is the case, if
these results are widely available? Of course,
if teachers are trained in the conventional
methods, they teach as they were taught and
trained to teach. One way to explain the situ-
ation is that standard instruction is couched
in a paradigm that promotes neither devel-
opment of reasoning nor conceptual devel-
opment. Paradigms define what is appropri-
ate, what questions can be asked, and what
questions are not asked. In the following,
this standard instructional paradigm and an
RC alternative will be described.

\textbf{Paradigm one: prevalent in most
standard instruction}

\footnote{12} Schooling in this paradigm is
about transmitting knowledge considered
important by the culture to young mem-
bers of the culture. While it is not explicitly
taught, one of the lessons most thoroughly
absorbed is a view of categories of students
in school, a kind of caste system, which is
then translated to their views of the world
outside of school.

\footnote{13} Teaching under this paradigm be-
comes the presentation of the official canons
of the culture by approved methods. Stu-
dents are tested on how well they can give
back the knowledge presented and skills at
which they have drilled and practiced. Stu-
dents who do not do well in such tests are as-
sumed not to be members of the upper caste
in school. The descriptions of the character-
istics of the castes of students are in terms of
mental ability or “gifts,” thus not under the
control of the teachers. Students who do not
do well are at the mercy of their own genes
and upbringing, both of which are out of the
teachers’ hands. In essence, the victims of
the paradigm one pedagogy are blamed for
their failures. When the teacher has present-
ed the official knowledge by an approved
method, then the teacher’s responsibility has
been successfully discharged.

\footnote{14} A more complete description of
Teaching in this paradigm is “the presenta-
tion of the established canon by approved
methods for the benefit of the deserving”

\footnote{15}http://www.univie.ac.at/constructivism/journal/9/3/302.gash
Education Research Concepts in Radical Constructivism

The argument goes: If we can reasonably knew what a phenomenon really was, we found most phenomena. Each time we thought we finally knew the “true” explanation. It is certainly not R. Hence, it is certainly not R.

Paradigm two: consistent with RC and socially just

In the second paradigm, all human beings are understood to construct for themselves working models of the world around them. These models enable them to function in the world. These models constitute their understanding of their world. Because these models are constructed in their minds, the conceptual entities of which the models are constructed are only in the realm of the mental. Since in this paradigm there is often a discussion on this issue about the existence of the conceptual entities in the “real” world. The argument goes: If we cannot know the “truth” of our theories, then is it not possible that a theory could be “true” even though we do not know it? The question is couched in the realist point of view. In RC, we know that we make up our theories to fit our experience. When they are found to fit experience and predict the outcome of future tests, the best we can say is that a theory fits experience and has predicted future tests accurately. We cannot say such theories are closer to some truth or “mind independent reality.” It is a trivial constructivism to say that our constructed explanations describe or might describe what is “actually” going on or actually exists. In the sciences, we know from history that we have experienced a sequence of explanations of most phenomena. Each time we thought we finally knew what a phenomenon really was, we found that the seemingly “solid” theory failed to explain certain new experiences. It seems the height of realist hubris to believe that now we finally know the “true” explanation. It is certainly not RC. Hence, I believe that the sentence “end noted” here can also appropriately be written: Because these models are constructed in their minds, the conceptual entities of which the models are made do not exist outside of the mind.

What is a teacher to do in this paradigm? An appropriate goal would be for students to leave having developed a different, more powerful understanding of the phenomena under study than they had when they started. Since human beings adjust their understandings of the world when existing understandings fail to fit their experiences, then a teacher’s task is to engage students in concert with others, they are also developing new reasoning patterns.

To paraphrase Gash in §10: The emphasis in paradigm two is on the student/experience interface instead of on the teacher/student interface, which is central in paradigm one.

Conclusion

I have pointed out that social interaction can be considered a type of experience that influences cognitive and psychological development in a way consistent with RC. One pitfall of considering social interaction as different from experience of the physical world is the introduction of the idea of a kind of knowledge that is a phenomenon of the social group, outside of mind. This notion of knowledge is counter to a basic premise of RC that knowledge exists only in the mind.

For all of the valuable research he describes, Gash has left us with a picture...
Author's Response: Perspectives on RC and Teaching
Hugh Gash

In response to the issues raised in the OPCs, I emphasize the following aspects: teaching cannot be transmitting knowledge, stages are too constraining a model, RC focuses on the individual construction and talking about social context invites the spectre of social constructivism.

> Upshot • In response to the issues raised in the OPCs, I emphasize the following aspects: teaching cannot be transmitting knowledge, stages are too constraining a model, RC focuses on the individual construction and talking about social context invites the spectre of social constructivism.

1 My target article “Constructing Constructivism” is about a narrow selection of either personal educational applications of RC experience or of constructivist research undertaken by colleagues. I welcome the challenges in the careful and thoughtful comments in these OPCs and I am very grateful to all the authors for their comments. As RC is a theory of knowledge, issues raised in the OPCs investigate the interpretation of RC epistemology and RC teaching, deepen ideas presented and raise important interpretive questions. The comments are discussed in sections on teaching and epistemology, the place of the social, trivialising constructivism and psychological issues. There are also a number of suggestions for the future.

Teaching and epistemology

2 Education plays a central role in the continuity of culture and knowledge. If, however, we say teaching plays an important role in the transmission of culture and knowledge, then the RC position is compromised by the metaphor “transmission.” This metaphor is commonplace, and Janet Bowers and her colleagues ($§3$), Arne Engström ($§$2–4), Theo Hug ($§$5) and Thomas McCloughlin ($§$5f) have each raised interpretive issues about teaching and its relation to RC in their OPCs.

3 RC was introduced as a call for epistemological clarity in relation to Jean Piaget’s theory (Glaserfeld 1974). Ernst von Glasersfeld agreed with Nell Noddings’s characterisation of RC as a post-epistemology (Engström $§3$), but it remains an epistemology, being concerned with the nature and limits of knowledge. So while an epistemology cannot prescribe teaching methods, and while epistemological educational and psychological issues can be examined separately and in isolation, it is fruitful for insights in associated domains to cross boundaries and influence relevant neighbouring disciplines. It is important that the identity of the form of information (epistemological, educational) does not become a block to the possibility of exploring implications and relations between the domains. Also, the relationship we have to knowledge at any moment influences our relationship to our own cognitive processes and to the person(s) to whom we are talking. If we are startled, we may be caught off guard and less circumspect. If we are outraged, we may want to impose our Reality. It is notoriously difficult to respect alternative realities when they violate our own boundaries and expectations. In Humberto Maturana’s (1988) terms, we orient to either objectivity-without-parenthesis or objectivity-in-parenthesis. Objectivity-in-parenthesis is when one recognises that objectivity is an illusion as there cannot be a match between reality and experience, consistent with RC, and one accepts responsibility for the concepts one uses to model experience. Objectivity-without-parenthesis is when one believes that knowledge is about matching what one knows with reality; reality is separate and the goal of knowledge is to represent reality. We position ourselves as separate from reality in objectivity-without-parenthesis or as connected in objectivity-in-parenthesis. People are never in greater moral danger than when they believe they have the truth.

4 RC teaching is where the teacher is sensitive to the process of construction in the learner with all the possibilities this awareness poses for considering alternative interpretations in the learner and in the teacher’s view of the learner. RC teaching is firmly in the domain of objectivity-in-parenthesis and valuing process. Using RC as a model of knowing requires putting teachers, pupils, knowledge, teaching, learning and all other categories used describing education in parenthesis, together with the links between categories. So in writing in an RC context, care is needed by the writer and reader to come to common understandings.

5 If learning is about requiring the child to learn what the teacher knows, about learning about Reality, then the process the learner uses is irrelevant. An alternative view from the learner is an error. However, we might want to talk about the teacher’s teaching as though it were divorced from learning, for example, to make some point about the activity of teaching. Teaching remains a process that is interactive with learners and ceases when the learners have stopped attending. As William Glasser (1986) indicated, teaching becomes very difficult when the learners have decided that they do not want to learn.

6 I agree that the word “teaching” has connotations that what is learned is passed directly from the teacher to the pupil (Bowers et al. §$3$) and so runs counter to the need within an RC perspective to sidestep this commonplace meaning. This is why many now prefer the phrase “teaching-learning.” An alternative in the wider educational community is to use the word “teaching” and explain what this means for a constructivist teacher.

7 Dewey Dykstra ($§$13–16) outlined a traditional educational approach (paradigm one) that he contrasted with an RC-based paradigm two. I think some of the difficulties with the concept of RC teaching may be alleviated by Dykstra’s presentation of RC teaching in his second paradigm ($§§17–23$) and I agree with his interpretation of some of the probable effects of the RC-based teaching model. McCloughlin ($§$6) also emphasises...
important benefits of RC teaching in ways that are consistent with Dykstra’s social justice benefits and open the way for innovative approaches that are not constrained by narrow boundaries and objectives.

1 8 My use of the metaphor “interface” was designed to avoid the word “teaching” and to emphasise the importance of the personal encounter in facilitating construction. Hug’s comment ($S$) on what is hidden is very apt. In focusing on teaching and learning and on teachers’ hidden epistemological premises and their relevance, we have not considered the learners’ experiences. The excitement, the emotion, perhaps the despair, the frustration and the boredom, these are central to the children’s educational and personal experience. These have not been prioritised because we have been thinking about teaching. The aim of the work described as constructivist teaching was to try to find ways to help children find exciting things to experience in school and to prioritise the child’s meaning making. This is an important focus. If meaning making is the aim, interest is vital. When RC is criticised in its educational application “as functionalist pragmatism in the service of neo-liberal developments” (Hug $S$), let us remember that no matter what the teacher teaches, it is the learner who decides whether learning will occur and whether a new equilibrium is going to be established or not (Dykstra $S$). The place of the social

1 9 This is a critical interpretive issue. There has long been an educational debate on the relative importance of the individual and the social. In the 1980s and 1990s this took the form of opposition between RC and social constructivism (Engström $S$). Bowers and her colleagues ($S$) and Dykstra ($S$) interpreted my use of words signifying “social” in a way I must clarify. McCloughlin ($S$) also mentions my emphasis on social construction and collaboration. The suggestion that constructivist pedagogy can be effectively assessed (Bowers et al. $S$) and that the unit of analysis in such assessment is based on social interactions (Bowers et al. $S$) is one I am anxious also to clarify. I would not claim that these social conditions guarantee constructivist teaching. Similarly, I accept that my use of the phrase “social construction” (target article $S$) is misleading. While the concepts were constructed in groups, my view is that each child constructs or does not construct the concept in the group activity. I want to stay radical: all construction is initially personal, and I agree that the use of the phrase is clearly misleading. The difficulty of being consistent and clear about this is underlined by Dykstra’s phrasing ($S$), and I will return to this in the section on “trivialising constructivism.”

1 10 Von Glasersfeld (1980), emphasising the importance of social experience, pointed out that Piaget 1 viewed certain concepts, including “organising immediate experience” and “the use of symbols to represent,” as arising prior to social concepts, and 2 maintained that conscious reflection arises in social interaction. Two comments are appropriate: first, conscious reflection can also arise independently of social interaction when one realises one’s expectations and experience do not match; second, initial studies within RC must first focus on particular concepts so that we can communicate without ambiguity. Engström ($S$) has also pointed out that Piaget emphasised the importance of social experience. This is what lies behind the fifth RC tenet (target article $S$). This also was why the Target article initially focussed on “RC as a frame for conceptual change” (Bowers et al. $S$). However, the third stage I proposed was not one in which the social conditions were an alternative to the RC position, or a development from an RC position. In my third stage, RC was axiomatic and taken for granted. The individual and the social are not alternatives; they are parts of the constructive process (target article $S$). The difficult thing about the third stage is that an emphasis on the social hides the radical nature of RC and, as McCloughlin ($S$) shows, the danger is that the radical side will be lost in the flow of classroom living. The importance of the social is reemphasised by Hug’s comment that my stage 3 “immediately suggests itself as a way of pointing out underestimated or sometimes forgotten aspects in radical-constructivist discourses” (Hug $S$). This alternative framing of types of constructivist approaches adds to methods that can be applied to critique RC research.

1 11 In the studies I introduced as exemplars in the second part of my article, teachers were working in classrooms to help children engage with tasks in ways that would genuinely enrich their learning experience. Not that an analysis of the teaching-learning process would guarantee constructivist learning in children (Bowers et al. $S$), and not that socially situated theories were going to be subsumed in a new stage of RC (Bowers et al. $S$). My intention was to describe studies working with teachers approaching learners so as to help the learner construct ideas that are more robust, and more likely shared, but the ideas do remain internal in each set of partners—teachers and pupils. In the studies I reviewed that Bowers and her colleagues mention ($S$), details are provided in the studies cited about changes in the children’s thinking. However, in my concern to emphasise the social context I did not focus on the individual, rather I focused on the ways the teachers sought to encourage or facilitate the child’s constructions. The teachers need to seek to treat the learners as “epistemic entities,” in Dykstra’s ($S$) terms. Moving from the individual to “the individual with another” means moving from the individual to the social. All interpretations of the social are initially personal and the social context is always interpreted.

Trivialising constructivism

1 12 One of the consequences of working with RC and using it in educational contexts is that interpretations inevitably enter into the applications. Trivialising constructivism is to ignore the RC premise that “the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality” (Glasersfeld 1989: 162). Bowers and her colleagues ($S$) and McCloughlin ($S$) call for more focus on RC, each pointing to the need to remember the premises. McCloughlin has emphasised the importance of the metaphor of “fit” with its associations to viability rather than truth ($S$), the importance of seeing knowledge as developmental ($S$) and indeed the need to examine the role of the word “radical” in the projects reviewed in the target article ($S$). Bowers and her colleagues see a danger that RC ($S$) will be watered down by focussing on collaboration or discursive positions; this is indeed a danger that McCloughlin ($S$) suggests can only be avoided by passing the baton to the teach-
ers. While teaching from an RC perspective will empower both the teachers (McCloughlin §6) and pupils (Dykstra §20), there is clearly a need to return iteratively to the premises to ensure the insights in RC are conserved.

« 13 » McCloughlin (§6) also cautioned that the circularity of recursive processes might be understood as a framework for rote learning and drew attention to the importance of auto-organisation, where dynamic meaning making of the learner is prioritised rather than self-organisation that may not involve feedback. Certainly, in my reference to recursion (target article §3), I imagined the loops to entail accommodative change at each iteration of the equilibration process.

« 14 » Teachers have widely varied interpretations of constructivism (Gash & Chocolouskova 2013) and seeking purity in conversation will probably result in new constructions, but this possibility is reassuringly consistent with RC. It is also important to remember that individual teachers change both across the year and from moment to moment. The concept “teacher” is one with its own connotations and it is important to remember that each teacher works with each child in a way that seems right at the moment. Each teaching encounter has its own freshness and complexity. One way to help teachers appreciate RC was demonstrated by Deidre Butler, who immersed teachers in extreme uncertainty with her LegoMindStorms project, asking them in workshops to construct slow moving toy cars. This experience was like a vaccination in that the teachers profoundly felt their inability and lack of knowledge. One teacher reported waking up in the middle of the night after a dream about Lego construction with the bedside lamp in her hand. Following these initiation teacher workshops, the teachers went to their schools and invited their children to design a project on the theme “Story, myth and magic.” In this broad context, the children in class proposed uses of the LegoMindStorms materials that brought the teachers to entirely new and unknown territory. The solutions had to be constructed de nuevo, and the teachers did not know the answers. The workshop experience followed by these classroom experiences changed the teachers’ relations with the pupils. So the mystery and the uncertainties that the teachers experienced led to epiphanies concerning their role as professionals.

« 15 » Engström (§4) mentioned a number of previous constructivist approaches. These constructivist approaches I think fall into what I termed stage one. What I find refreshing is the paradigm shift in RC, when one sees that ideas are the result of mental operations (target article §2), and understands that this insight has implications for one’s relationship with the world: one is part of the world not apart from it.

« 16 » Additional key features of RC learning that Engström (§6) emphasised are the importance of levels of learning and the relationship between doing and understanding and the relation between them in the context of maths. Maths is indeed different from biology (Engström §6). I want to make a comment on the nature of maths and ontology. I think that maths is different because maths is a model and does not correspond with reality. So maths escapes ontology and achieves certainty and truth because it is a model. This was a thesis put forward by Vico and mentioned in Gash & Glaserfeld (1978). It is neatly captured by the definition of points in geometry as having location but not extension.

« 17 » The essential issue, I think, is the importance of the level of information in RC. We can count (action), and the result of the counting (organisation) is at a different level. It is just the same with grouping plants into families, where the family is a mental organisation. Indeed, the object “particular plant” for me and what I see changes dynamically whenever I listen to a botanist explain plant structures. Dykstra (§5) also mentions levels and distinguishes experience of objects from experiences of our operating on objects. Being rigorous about RC and language, we construct the objects, but at a different level from the organisational level of their manipulating. It is hard to keep the language in check. The target article touched on this issue of levels (§§9, 18) in relation to conservations about social identities such as gender and race. This would apply also to the “caste system” Dykstra deplored (§§13–16). When children learn about differences between, for example, boys and girls, they learn to conserve these different features and so learn prejudices. We call them “stereotypes” but they are mental organisations that do not correspond with boys and girls, just some temporary experiences of boys and girls that “fit” well enough for some to use them. These prejudices serve to organise their experience and while conserved, form part of their owner’s identity. So some children learn to value certain types of people and to dislike others. It is very hard to change these likes and dislikes because they are part of the child’s identity. If the child changes her likes, her identity is called into question. This drawing attention to the complexity of the origins of consciousness through reflective abstraction is a forceful reminder of the reorganising features of constructed knowledge (Engström §7). I think that the research I reviewed in the first part of my article meets this criterion of levels and meets the two RC criteria, so is more than the trivial constructivism Engström (upshot) attributes to it.

« 18 » When knowledge is constructed it is new for the learner. It is about new understanding. It is about insight and epiphanies and empowerment. It is about the wonder described in Butler & Gash (2003). It remains important to recognise, as Paul Harris and Melissa Koenig (2006) have emphasised, that children learn much from testimony and some of that learning will be acquired under stage one conditions. I suspect that when children learn through testimony about religious concepts and scientific concepts, there are key features about their orientation to these concepts that they learn non-verbally: attitudes to cleanliness of food and to prayer are two examples. I raise these issues here as what is learned might be learned in a trivial or rote way, whereas the child has learned something much more fundamental about cleanliness (dismissive or not) or about prayer (reverential or not). So I suspect that children may learn paradigms from testimony and I agree that changing these ideas in class will require more than standard instruction (Dykstra §12).

**Psychological issues**

« 19 » Constructing constructivism implied for the author a longitudinal change in thinking about models of thinking using stages. Indeed, as Hug ($3$) noted, the concept of stage had in part a didactic function, and Hug in the same paragraph outlines another...
way of categorising constructivist approaches to education, suggesting that much can be learned from “contrasting such overviews and basic distinctions.” I agree, and I see stages as loose heuristic ways of describing qualitative differences in thinking, rather than strictly logically related steps moving from one set of assumptions to another, hopefully more viable, set. It is difficult to be consistent with RC, as these OPCs point out. Further, the additional difficulties that Hug (§4) mentions with stage classifications also point to the over-simplification entailed by the three stages I outlined (§§4–10). With the benefit of these OPCs, I feel my stages were a good beginning. I accept that it is also difficult not to take one’s latest set of insights as truth, though this is probably driven by a need for certainty with biological benefits.¹ In this context, I am favourable to Engström’s (§1) suggestion that discourses are a helpful way to discuss cognitive changes. The notion of discourses allows a place for different ways of describing and explaining. However, I used the notion of stages to highlight the paradigm shift that occurred when von Glasersfeld introduced RC, and this can be usefully presented as a second stage contrasting well with the less epistemologically challenging constructivisms that preceded it. Having invented the idea, one must then present it socially (speak or write) and see if others can make sense of it. Charles Smock and Ernst von Glasersfeld hoped that the relation between RC and Piaget might be clarified when they sent the volume of papers that included Glasersfeld (1974) to Piaget in Geneva. Unfortunately the response, while supportive, cannot be considered definitive (Gash 2011). We are clear what RC means, and that is a good basis on which to proceed. My suspicion is that the impossibility of matching experience with reality is becoming more generally acceptable and see signs of this, e.g., Luciano Floridi (2011).

**Important suggestions**

§20. Each issue raised here has its own energy and importance. Engström and Bowers each raise the issue of inter-disciplinarity. It seems that there is a place for disciplinarity when we consider RC as a form of epistemology and how it relates to Piaget’s work. In such considerations, conceptual clarity is required in domain-specific ways. However, when we look at these OPCs as a group, it is clear that RC has important educational implications. We need a dynamic model where the influences of RC can help explain how the different perspectives – post-epistemological RC, psychology and education – coalesce in creating the present. We also need to ensure that the important insights are not diluted or “morphed” in the process (Bowers et al. §8).

§21. Hug (§6) mentioned blind spots in my review, including the arts and digital media. The arts certainly, digital media perhaps, as in Deirdre Butler’s (2004) work further examples could have been developed. These are areas that need attention. The paper would be richer with suitable examples, had I such. Hug (§7) also suggests that the overall approach adopted in the target article may be a useful way to sound out options for designing spaces for education. In the first part of the article I approached this task with questionnaires; I am sure there are other effective ways to do this and hope that this work may provide encouragement.

§22. Finally, Philip Boxer and Vincent Kenny (1990) provided an analysis of management discourses. Their model may be helpful in examining the problems that arise when one shifts focus from the individual constructing to the social context where this occurs. I hope what follows will be helpful.

§23. At times a team of footballers have an inspired match. They play as a unit, they have grace, they have style and there is synergy. One can look at them as a social group and one can describe the moves as a social objective event and the smoothness of the play can be described as graceful. Also, and alternatively, one can look imaginatively at what each player’s individual experience appears to be. What has happened is that they are each interpreting their moves personally in a reciprocal way. They cannot make a mistake because they anticipate each and every player’s every move and one can empathise with the pleasure in the play. From an RC perspective, what is important is that they are each interpreting from their own perspective. Whether that is social and outside of mind or not depends on the descriptive perspective.

§24. This can be applied to education, with Boxer and Kenny’s (1990) model. If we look at the child constructing, then the social dimensions concerning what the teacher is saying and what the other children have just said are hidden. If we take the teacher’s discourse and the children’s questions as the focus, then the child’s constructing is hidden. All this depends on the perspective. Then we might be interested in what the child is doing or how the child is doing it. These aspects will be obscured but not invisible when we look at either the social dimension or at the individual dimension. The importance of this model is that it allows us to realise that each perspective necessarily hides or obscures other valid features of the whole experience. It clarifies that each dimension of the experience remains intact.

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