Discussing, sharing and collaborating: Distributed constructionism goes online

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Abstract
Online curriculum projects are ideally suited to provide spaces for learners to discuss construction activities and contemporary web tools allow the enactment of theories offered in the late 20\textsuperscript{th} Century, particularly those relating to distributed constructionism and the potential of the Internet to enhance teaching and learning. This paper presents a post hoc analysis, using five participating schools as a theoretical sample, of a 2007 online curriculum project, Land Yachts, which involved 142 pre-service students (in 48 teams), 477 primary school students (in 143 teams) and 18 classroom teachers from locations as diverse as Far North Queensland and Western Australia. The analysis will outline the online discussing, sharing and collaborating on constructions that students undertook in order to enhance and extend their knowledge. The paper will conclude that distributed constructionism has much to offer as a framework for designing online curriculum projects but that changes in technology have afforded differing and much interactive connections between learners.

It is widely held that “it has taken time for … underlying technologies to become sufficiently powerful, easy to use, and widely available to have the potential to affect the daily lives of ordinary people” (Albion & Maddux, 2007, p. 304). A similar argument can be mounted that it has taken time for technology to have the power to seamlessly support pedagogy. This paper will consider the example of the learning theory of distributed constructionism (Resnick, 1996a, 1996b) which was arguably conjectured before its time had come, that is, before the advent of Web 2.0 technology and its availability in schools made it possible to create and test authentic applications of the theory.

This paper will use the example of a recent online curriculum project, Land Yachts, hosted by the oz-Teachernet based in the Faculty of Education, Queensland University of Technology, and argue that it is a contemporary exemplar of distributed constructionism. Using post hoc analysis of project interactions, it will show how knowledge can be shared and created through asynchronous online discussion and collaboration to enhance student learning.
The discussion in this paper will be presented in four sections. The first is a background section which will briefly describe the theory of distributed constructionism and outline the processes and outcomes of the *Land Yachts* project. The second is concerned with the research methods used to inform the findings presented in the third section of the paper. The fourth and final section will conclude the paper.

**Background**

This section will address (a) the theory of distributed constructionism, and (b) the *Land Yachts* project.

**Distributed constructionism**

Distributed constructionism (Resnick, 1996a, 1996b) is an intriguing but relatively unknown learning theory which emerged from the MIT Media Laboratories in the 1990s. It is a variant of constructionism initially articulated by Harel and Papert (1991). A deconstruction of the seminal theories underpinning distributed constructionism is summarised in Figure 1.

![Figure 1: Theoretical derivation of distributed construction](image)

The starting point of the derivation summarised in Figure 1 is *constructivism*, which is well known and understood as a theory of learning grounded in the work of Piaget (1950) and Brown, Collins and Duguid (1989). Put simply, constructivism proposes that learners actively construct knowledge through a process of accommodation and assimilation (Piaget, 1950). Constructivism also acknowledges the social nature of learning and Brown et al. (1989) used this theory – badged as social constructivism – to explain how knowledge is formed through the complex relationship between the learner, instructor, fellow learners, culture and context. Understandings of the social and collaborative nature of learning can be further associated with Vygotsky’s (1978) notion of a zone of proximal development (ZPD), that is, the distance between the actual developmental level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers. An understanding of ZPD helped to define how the collaboration between learners aided in the development of knowledge.

Harel and Papert (1991) proposed that a new learning theory, *constructionism*, emerged when the facilitative impact of a product or artefact was added to the constructivist learning equation (see Figure 1). Constructionism – described in the 1990s as both a new approach to learning and a new pedagogy - built on the perception of knowledge creation as the result of active interactions with the world but distinguished it as being more effective when learners were engaged in constructing personally meaningful products (Papert, 1991). In the first
usage of the term – in a submission for a National Science Foundation (NSF) grant relating to the use of the Logo programming language to teach mathematics – it was argued that:

The word **constructionism** is a mnemonic for two aspects of the theory of science education underlying this project. From constructivist theories of psychology we take a view of learning as a reconstruction rather than as a transmission of knowledge. Then we extend the idea of manipulative materials to the idea that learning is most effective when part of an activity the learner experiences as constructing a meaningful product.

(Papert, 1991a, para. 1, emphasis added)

A useful definition of constructionism can be determined through the following:

My little play on the words *construct* and *constructionism* already hints at two of these multiple facets - one seemingly “serious” and one seemingly “playful.” The serious facet will be familiar to psychologists as a tenet of the kindred, but less specific, family of psychological theories that call themselves constructivist. Constructionism - the N word as opposed to the V word - shares constructivism’s connotation of learning as “building knowledge structures” irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it’s a sand castle on the beach or a theory of the universe.

(Papert, 1991b, p. 1, emphasis added)

The remaining theoretical component of the distributed constructionism equation (see Figure 1) is distributed cognition (Hutchins, 1995a, 1995b; Salomon, 1991). In this, cognition is not perceived as the behaviour of the individual but rather as that of individuals interacting with their environment and encompassing interactions with both objects and people. Not only is knowledge enhanced and produced via social interactions, but so too is cognition, intelligence and understanding. Knowledge within an individual is combined with knowledge “in” the world and is premised on an understanding of a cognitive system comprising of the individual, the community and socio-cognitive tools (Salomon, 1993).

Resnick (1996a; 1996b) coined the phrase **distributed constructionism** to explain how computer networks could be used to support the shared construction of knowledge, particularly where students work together on design and construction activities. The theory argued for an alternate “vision” of the use of computer networks in teaching and learning with the salient difference being that:

This vision puts construction (not information) at the center … It views computer networks not as a channel for information distribution, but primarily as a new medium for construction, providing new ways for students to learn through construction activities by embedding the activities within a community. (para. 5)

Distributed constructionism (Resnick, 1996a, 1996b) views computer networks as the medium for construction with the networks providing the space for learners to engage in collaborative construction activities. It gives a label and theoretical frame to the understanding that knowledge – as a “spiral of knowing” - is constructed through reflection and mental engagement with people, problems and artefacts (Wells, 2002, pp. 200-202). This notion of working together in a virtual space is why distributed constructionism had particular resonance with the Land Yachts project to be outlined in the following subsection. The participants used the *Land Yachts*’ online blogging spaces to record and share progress, discuss design ideas, upload images and video, receive feedback on construction and tabulate
results. This use of more interactive forms of technology, generally dubbed as Web 2.0, has seen “the Internet … mature in its transformation to a social platform” (Weaver & Morrison, 2008, p. 97). The contemporary understanding of the read/write web is significantly different from the fledgling telecommunications available when the notion of distributed constructionism was initially proposed.

Distributed constructionism has three main categories of activities: discussing constructions, sharing constructions and collaborating on constructions. Resnick (1996a) offered that:

… the Internet acts as a type of Rorschach test for educational philosophy. When some people look at it, they see a huge database for students to explore. When I look at the Internet, I see a new medium for construction, a new opportunity for students to discuss, share, and collaborate on constructions. (para. 23)

Discussing, sharing and collaborating constructions are the activities that allow “people [to] think in conjunction and partnership with others and with the help of culturally provided tools and implements” (Salomon, 1993, p. xiii). They are not linear as learners engage in them continuously and are best described as being iterative and interdependent processes. The interconnectedness between discussing, sharing and collaborating is represented in Figure 2.

The notion of discussing, sharing and collaborating resonates with McCormick’s (2004) contention that “technology educators … are trying to get children to be able to … think through their doing, and for the feedback from this doing to affect their thinking” (p. 23). In the analysis of findings in this paper, the three-part structure (see Figure 2) will be reduced to two, namely, sharing and collaborating. The third component – discussing – in the instance of online blogs becomes an agent which facilitates the other activities.

To be fully enacted, distributed constructionism (constructivism + artefact + the Internet) requires the distributive agency of the fast, robust and accessible connections now possible through Web 2.0 tools and ubiquitous networking. That technology has finally begun to catch up with theory is evident in projects such as Chapman’s (2001) “pearls of wisdom” which transposed distributed constructionism into a “constructionist co-operative” and drew on foundational notions of knowledge-building communities (Lave & Wenger, 1991; Scardamalia & Bereiter, 1991) and learning webs (Freire, 1970; Illich, 1971). Similarly, Harel (see Harel Caperton, 2008) has – through the MaMaMedia and Globaloria projects - begun to redefine constructionism in terms of new technologies. In the closing keynote address at NECC 2008 (National Educational Computing Conference), she described a
dilemma between “contemporary” or “modern” to describe the renewed forms of constructionism (Harel Caperton, 2008).

The distributed constructionism initially proposed by Resnick (1996a; 1996b) acknowledged how cognition is altered in situations where more than one person is involved in design and construction activities in an online environment but could not offer much in the way of exemplary practice to illustrate or test the theory. The following sections of this paper will describe – as Resnick (1996a; 1996b) attempted to do in the initial discussions of distributed constructionism – how an active project, here Land Yachts (to be described in the following section) exemplifies the theory and in so doing, can describe new ways of thinking and learning afforded by interactive online technology and supported by online communities.

Land Yachts

The oz-Teachernet [http://www.oz-teachernet.edu.au] was established in 1995 to assist teachers using the Internet and to support professional development and curriculum design. It is a non-profit self-funding community managed by academics and was the first of its kind in Australia. Land Yachts is a recent oz-Teachernet online curriculum project and has been commended internationally for its originality and pedagogical value.

The ostensible purpose of the Land Yachts project was the collaborative building of small wheeled vehicles from recycled materials (see Figure 3). The “real” purpose, however, was to model the meaningful use of asynchronous Web 2.0 technologies in teaching and learning, test ideas about distributed constructionism (after Resnick, 1996a, 1996b) and to scaffold student learning in the context of the Technology Key Learning Area. In its initial iteration over six weeks in Term 3, 2007, the participants in the project were 142 pre-service students (in 48 teams), 477 primary school students (Years 4-7, in 143 teams) and 18 classroom teachers from locations as diverse as Far North Queensland and Western Australia. While pseudonyms are given for schools referred to in this paper, the original team and yacht names are retained in an effort to portray the sense of ownership, originality and energy exhibited by the student participants. The 2008 iteration of the project has included both Australian and international participants.

Each team (N=191) – comprising of both children and pre-service teachers - entered the results of their trials and uploaded photos and videos to a secure online database. These were displayed in an interactive website developed within the oz-Teachernet domain. A blog (web log) attached to each participating team’s page was used to maintain a log of each team’s progress as well as accepting comments from other participants (see Figure 4). A “race day” was nominated as a culminating point in the project. The project was not competitive and all participants received a certificate. Figures 3 and 4 are taken from the team page of a Year 5 team, the Maths Lexus, from a metropolitan school. Figure 3 shows – through a series of images - the developing construction of their yacht, “The Bumpy Ride,” over time while Figure 4 captures:

- the team’s initial design note including emoticon, that is, “<(-_-)> We will use a 2L milk bottle hull, with a four wheel design”;
- the recording of trial times and distances; and,
- a sample of the team’s blog entries, that is:

  Today we tested the different types of sails we have designed. We are trying to work out which one works best. We were surprised that the land yacht still travels without a sail!!! It's not quite ready for the actual race yet, but at least it runs straight, and does not need
the third setting on the fan to go to end of our tables. We're also testing the roll of masking tape and a pen.

Figure 3: Development of the Bumpy Ride (Maths Lexus)

| Land Yacht: The Bumpy Ride | Design Notes: We will use a 2L milk bottle hull, with a four wheel design. |

Team Results

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Distance Travelled (m)</th>
<th>Time Taken (s)</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 5, 2007</td>
<td>Rock Day</td>
<td>5.2</td>
<td>11</td>
<td>We were very happy with our results when we compared them to last time. &lt;17%=5%&gt;</td>
</tr>
</tbody>
</table>

Blog

Add

Thursday, August 30 2007

10:31 am Testing Day

Today we tested the different types of sails we have designed. We are trying to work out which one works best. We were surprised that the land yacht still travels without a sail! It's not quite ready for the actual race yet, but at least it runs straight, and does not need the third setting on the fan to go to end of our tables. We're also testing the roll of masking tape and a pen.

Figure 4: Excerpt from the Maths Lexus Team Page

The purpose for taking what is effectively a hands-on Technology project into a collaborative online space can be summed up in the following observation:

The posting of content [online] does not happen in a vacuum. Content is posted so that an audience, regardless of how that audience is limited by restrictions, might see it … And often that audience responds to the content posted online, making the content as much about interaction with others as it is about sharing with them.

(Pew/Internet, 2007, p. 23)

The purpose is similarly connected to notions of “working technologically” or “working scientifically” popularly adopted to increase the authenticity of classroom activities. In this,
team members work through computer networks – sometimes with remote partners – to achieve a collaborative outcome. In the *Land Yachts* project, students were asked to explain and justify the construction decisions they had made and to engage in repeated trials of their design. Communicating with others and accepting (and expecting) external feedback are key components in this mode of working and are furthermore central to the underlying principles of distributed constructionism evidenced in the project. Through online collaboration and interaction, they redressed the misunderstanding that “the emphasis on finding and describing ‘knowledge structures’ that are somewhere ‘inside’ the individual … overlook[s] the fact that human cognition is always situated in a complex sociocultural world and cannot be unaffected by it” (Hutchins, 1995b, p. xiii).

Online curriculum projects – in line with theories of distributed constructionism - are ideally suited to provide spaces for learners to discuss construction activities. This may be achieved via the use of email, discussion lists or, as in the *Land Yachts* project, via team blog spaces. These communication channels present an opportunity for learners to share ideas about their design, report on progress, explain the strategies they have used and receive feedback or advice from other groups. The blogs (N=1009) in *Land Yachts* were minimally scaffolded and the only instruction given was for each team to gather and record data during the construction and testing of their yachts and share this data with other teams via the website. The focus of the team blog was therefore to share iterative design and construction processes. As with other blogs, the opportunity for others – including other team members – to comment was made available.

The team pages were directly and purposefully scaffolded through the provision of specific areas for differing kinds of text and graphic input, for example, information could be entered about team members, design notes, and trial results as well as recording a team’s activity through the blog space itself and image uploads (see Figures 1, 2 and 7). The provided information was a rich shared source of information that encouraged other teams to comment or leave messages of advice regarding the design and construction of others’ land yachts.

![Figure 7: Team page template](image_url)
**Method**

The findings presented in this paper were the outcome of a post hoc analysis following the first iteration of the *Land Yachts* project in 2007. The data sources were the project’s online artefacts, that is, digital images, digital video, trial data, and blog entries supplied by project participants.

The analysis of pre-existing data for this paper consisted of two main stages. The first involved tallies of all uploaded data. The second consisted of a detailed examination of blogs and comments to create notes on the activities described as components of distributed constructionism, namely, discussing, sharing and collaborating (see Figure 2). Open coding (after Neuman, 2003; Strauss & Corbin, 1997) was used to identify and disclose concepts and categories within the broadly identified activities of sharing and collaborating.

Details of the participants have been cited in the previous section. It should be noted, however, that the participating schools (*n*=16) represented a roughly even mix of public and private schools but there was a predominance of rural over metropolitan schools. There was no discernible gender difference in student representation or team composition.

To simplify the presentation of findings in this paper, a theoretical sample has been made of five participating schools to illustrate the selected activities, namely, sharing and collaborating noted through the project. The five schools will be referred to as School A, B, C, D and E. Simple descriptive details of these schools including a snapshot of the differing levels of participation observed across the teams is presented in Table 1. This will indicate that the selected sample represents a range of participation within each of the offered variables.

<table>
<thead>
<tr>
<th>School</th>
<th>Year level(s)</th>
<th>Age range</th>
<th>Teams</th>
<th>Average recorded trials per team</th>
<th>Digital images (total)</th>
<th>Digital video files (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Year 4</td>
<td>9-10</td>
<td>9</td>
<td>5-6</td>
<td>39</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>Years 5-6</td>
<td>10-12</td>
<td>9</td>
<td>2-3</td>
<td>34</td>
<td>11</td>
</tr>
<tr>
<td>C</td>
<td>Years 6-7</td>
<td>11-12</td>
<td>9</td>
<td>0-4</td>
<td>12</td>
<td>08</td>
</tr>
<tr>
<td>D</td>
<td>Years 4-5-6</td>
<td>10-12</td>
<td>6</td>
<td>2-3</td>
<td>11</td>
<td>08</td>
</tr>
<tr>
<td>E</td>
<td>Years 6-7</td>
<td>11-12</td>
<td>10</td>
<td>0-3</td>
<td>34</td>
<td>09</td>
</tr>
</tbody>
</table>

**Notes to Table 1**

1. The project was open to classes from Years 4-7. Several, as with Schools B-D were composite or multi-age settings.
2. The age range in the project was 9-12 years. In this sample, Schools A and D include the youngest participants while Schools B- E include the oldest.
3. Overall, 2-6 races per team were recorded in the Team Results tables. The sample schools show a range of participation with School A holding the highest number of “races” or trials.
4. Overall, 11-39 digital images were uploaded per school. School D submitted the lowest number of images (*n*=11) while School A submitted the highest (*n*=39)
5. Overall, 6-20 video files per school. School A submitted the highest number (*n*=20) while Schools C and D submitted the mean number of videos uploaded per school (*n*=8).
Findings
The activities of distributed constructionism previously discussed in this paper and represented in Figure 2 will be used to structure this discussion of findings. These are: sharing constructions and collaborating on constructions. The third activity, namely discussing constructions, is, as previously noted regarded in this instance as the agent which facilitates the others.

Sharing constructions
The actual posting of content, freely available to other participants once logged into the secure website, was recognised as evidence of sharing. This was heightened when posted information moved from being purely descriptive to being more detailed or personalised. There was evidence of teams sharing constructions beyond a descriptive level, that is, when team results were explained or anecdotal evidence was included (see Figure 4). Similarly, the Team Results, shown in Figure 5 share comments about a reluctant yacht that stopped and started, then started again! These fostered empathy between the project participants and allowed a sense of a supportive environment for design and construction to take place.

![Figure 5: Example of team result table (The Jungle Bongo, School B)](image)

The more visual method of sharing, that is, the posting of digital images of the land yacht, at various stages of construction and the posting of colour drawings of early plans (see Figures 3 and 6) were effective tools for teams to share ideas, show progress and provide visual cues for other teams who may emulate or refine demonstrated ideas. The impact of these images was clear, as other teams would post messages in blogs commenting on these images, such as “Good wheels! A little bit of sand paper would make the wheels run really smooth on the track. I like your yacht - it looks cool!” (Comment to Almakash, School E, from a teacher in another participating school). This is in keeping with findings from the Pew/Internet American Life Survey (2007) which showed that about half (52%) of teens who post photos and a little under half (48%) of those who posted videos frequently receive comments or other feedback on their postings.

![Figure 6: Examples of digital images posted to team blogs](image)
Collaborating on constructions
Two distinct forms of collaboration became evident through open coding of the blogs and comments. These were (1) collaboration amongst team members \((n=593)\), and (2) collaboration between teams and other teachers/pre-service teachers \((n=416)\). The postings made by teams to their own blogs were generally descriptive accounts of their collaborative design and construction process with some explanations or insights into the choices they made. Postings made by others \((n=416)\), were generally concerned with sharing and supporting those collaborations. This coding is summarised in Table 2.

Table 2
Evidence of collaboration on constructions

<table>
<thead>
<tr>
<th></th>
<th>Team Blogs ((N=1009))</th>
<th>Own postings ((n=593))</th>
<th>Postings from others ((n=416))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaboratively sharing design and construction processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of construction processes</td>
<td>121 (20.40%)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Trialling constructions and predicting</td>
<td>184 (31.03%)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Evidence of teamwork/collaboration</td>
<td>288 (48.57%)</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2. Sharing and supporting collaborations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supportive comments/Sharing experiences</td>
<td>N/A</td>
<td>256 (61.54%)</td>
<td></td>
</tr>
<tr>
<td>Offering a suggestion/Asking a question</td>
<td>N/A</td>
<td>160 (38.46%)</td>
<td></td>
</tr>
</tbody>
</table>

1. Collaboratively sharing design and construction processes
The postings \((n=593, N=1009, 58.77\%)\) generally classified as “collaboratively sharing the design and construction process” were largely concerned with describing the design and construction processes teams were undertaking. They also included attempts to make sense of the decisions made and predictions of future modifications to the design of the land yacht under construction. These postings \((n=593)\) were further coded as:
(a) description of construction processes \((n=121, 20.40\%)\);
(b) trialling constructions and predicting \((n=184, 31.03\%)\); and,
(c) evidence of teamwork and collaboration \((n=288, 48.57\%)\).

Description of construction processes: These were descriptive postings of the team’s design and construction processes, for example:

> In our test we travelled pretty well. We have made some changes. Our group has made a new sail that traps the wind really well. Our wheels are now attached and are working better than our last wheels made of CDs. The CDs didn’t give much support to the body of the land yacht but the balsa wood works much better. We hope everyone has a good racing day!!

\((Dusty, School E)\)

Trialling constructions and predicting: These messages described a team’s trials and included comments on design modification or adjustment. They also predicted future results, such as going faster due to a modification or the distance they think their land yacht may cover. An example of this code was:

> The Wasp is up and ready to go. We have changed our yacht’s design a little bit because we think it will go faster. We added a new sail that has helped it go further.
We have added some rubber bands on each side of all the wheels but that made it go slower. We think our yacht is going to win.

(The Wasp, School B)

Evidence of teamwork/collaboration: Teamwork and collaboration were, at times, implicit in team postings, such as the use of “we” and the description of the activities the team was undertaking, or it was explicit with names of different team members and their roles being supplied. An example of this was:

We have changed the wheels and instead of two wheels at the front we had one wheel at the front. We made the sail smaller and we used skewers to hold the sail together. 90% of our measurements have changed because we have made lots of mistakes. We have a new person in our group and he has done a load of work. Instead of using duct tape, we used sticky tape. We predict it will go about 4 or 5m.

(Lightning Struck, School D)

2. Sharing and supporting collaborations
The postings generally classified as “sharing and supporting collaborations” (n=416, N=1009, 41.23%) offered supportive comments and general encouragement to teams in response to problems, poor results or project completion. They also included postings that shared experiences and offered suggestions. There was a clear differentiation between these and other messages relating to a sense of interaction rather than broadcast, of having read and noted others’ postings and images and perhaps having gained new insights from this experience. These messages were further coded as (a) supportive comments/sharing experiences, and (b) offering a suggestion/asking a question.

Supportive comments/Sharing experiences: An example of this was:

Hi, sorry about what’s happening. Maybe I should give you a tip, you should use a skewer and put as straw threw [sic] it and that’s how we won.

(Thingymabob, School E)

Offering a suggestion/Asking a question: These were often quite short postings that clearly offered a solution to a problem. Some teams, rather than offering a solution, asked a leading question or made a general – frequently unsolicited - suggestion, for example:

I really like your name! THE FLAMING DUTCHMAN! I think maybe changing your wheels might help a bit more. Well done! (The Flying Dutchman, School A)

This analysis – drawing illustrative examples from the sample schools (N=5) - has demonstrated how the students in the Land Yachts project were engaged in sharing their design and construction processes and how they collaborated with other teams during the project. The online nature of the project provided a medium through which teams could provide details of their constructions and offer suggestions or share experiences. The interaction added a dimension to the project and heightened students’ motivation to continue and to complete their constructions. This coupled with the evidence of the activities described by Resnick (1996a, 1996b) marks the Land Yachts project as an exemplar of distributed constructionism made possible by the contemporary existence and use of Web 2.0 tools.

Conclusion
While Resnick (1996a, 1996b) described the processes of distributed constructionism as the discrete processes of discussing, sharing and collaborating (as noted in Figure 1), our findings
saw less distinction between these and led us to reassign “discussing” as an agency of the other two activities. Taking distributed constructionism online has arguably changed the nature of the processes and has seen them become intermeshed in ways to make their differentiation difficult to discern. For example:

1. the process of *discussing* was pervasive because blogging facilitates a dialogic rather than broadcast mode of communication.
2. the process of *sharing* was mandatory because of the online format – all blogs, comments and images were “shared” between all participants irrespective of their location within Australia. This is evident in the previously cited findings related to blog entries and image uploads (see Table 1).
3. the process of *collaborating* was largely off-line but allusions to team processes were evident in the on-line commentary. On-line collaboration was evident through processes of scaffolding and in the instances (noted in Table 2) where individuals and other teams offered a comment in support of a particular team’s design and construction process.

It could be argued that the online environment itself melded these processes into a more cohesive mode of communication. The participating students were operating in relatively familiar spaces and there seemed to be little difference between reactions to and interactions with known and unknown participants. Students and teachers “talked” across school and classroom boundaries and the overall effect was of a supportive and active environment. It is clear that Resnick’s (1996a, 1996b) theory of distributed constructionism was enacted but - as with Leonardo’s aeroplane or submarine – it changed its form because of the technology of its time. Changes in technology, particularly Web 2.0 tools, have afforded differing and more interactive connections between learners than Resnick expected or could have predicted. It has also allowed asynchronous interaction between remote partners thus extending the four walls of the classroom and adding to the diversity of participants.

We would contend that distributed constructionism has much to offer as a framework for designing online curriculum projects and in theoretically grounding the emerging field of digital pedagogy in cognitive science. The *Land Yachts* project described in this paper has shown that new ways of thinking and learning - unconstrained by physical and temporal spaces - can be afforded by interactive online technology. The technology has finally caught up with the theory!

**References**


