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# Building Zones of Proximal Development with Computer Games in a UC Links After-school Program

*Robert Lecusay*

**Abstract:** There is widespread agreement that further research is needed in order to identify afterschool program characteristics useful for understanding why some programs are more successful than others. The bulk of recommendations put forth by researchers, practitioners and policy makers focus on observable characteristics of the afterschool setting as a whole. While these characteristics can be recorded on checklists for later aggregation into a quantifiable evaluation of the system, it is important to remember that they are the products of interactional processes. In the present analysis I focus on the dynamic human interactions that comprise these system-level evaluations. Drawing on video documentation of adult-child computer mediated activities in a UC-Links afterschool program, I illustrate how UC-Links design principles – which focus on the creation of *cultures of collaborative learning* – promote the learning and development of participating youth. In particular, I show how implementation of these principles support one of the key tasks in achieving quality teaching-learning after school: the successful negotiation of a common ground of engagement between interlocutors in an instructional interaction.

**Keywords:** Afterschool Education, Collaborative Learning, Informal Learning, Zone of Proximal Development

## 1 Introduction

As noted by Underwood and Parker (current volume) extensive research in recent years has identified a number of factors that are associated with "high quality" afterschool programs including a safe environment, activities that promote active engagement, the ability of youth to work in small, intergenerational groups, and extensive opportunities for participants to make choices based on their own interests (Eccles/Gootman 2002; Smith/Hohmann 2005). However, there is also widespread agreement that more research is needed in order to identify program characteristics that can help us understand why some programs are more successful than others (Durlak/Weissberg/Pachan 2010).

The bulk of the recommendations put forth by researchers, practitioners and policy makers focus on observable characteristics of the setting as a whole, such as opportunities for youth to communicate and collaborate with adults in a friendly and

non-coercive way. These characteristics are the products of interactional processes that can be recorded on checklists for later aggregation into a quantifiable evaluation of the system as a whole (Jones/Bench/ Warnaar/Stroup 2013; Papazian/Noam/Shah/ Rufo-McCormick 2013).

The present analysis, in what I intend to be a complementary fashion, focuses on the dynamic processes of interaction that comprise these system-level evaluations in face-to-face interaction between undergraduates and local youth at La Case Mágica one of the UC Links sites located in a suburb in Southern California.

### *Theoretical Foundation for Organizing Undergraduate-Youth Interactions*

The activities at La Clase Mágica (LCM), like the activities of the Fifth Dimension, from which it was adapted, shared the characteristic that they were designed to create a "culture of collaborative learning" (Nicolopoulou/Cole 1993). A number of common principles guided the design process in order to make routine the kinds of interactions I will discuss below. These included careful attention to the intentional mixing of generations in the activity, and the provision of a great variety of activities so that the children could choose activities of interest to them. They also included careful attention to the local needs of the community institution and its constituents. These and other considerations went into designing the after-school activities at the site.

With respect to the organization of specific activities which, as an ensemble, served as the "curriculum" of the activity, the lineage of those UC Links programs that have drawn inspiration from the Fifth Dimension/LCM tradition have also employed theoretical ideas inspired by the work of the Russian developmental psychologist L.S. Vygotsky. Like many others (Brown/Campione 1990; Bruner 1990; Rogoff 2003), I have found that Vygotsky's ideas, focused around the notion of a zone of proximal development (ZPD) provide a practical way to organize the teaching/learning process. What is new in the current approach is that it moves his ideas out of the classroom and into the after-school setting, where they have proven especially helpful.

## 2 Implementing Zones of Proximal Development in a UC Links setting

Typical of the ways in which UC Links programs are organized, LCM is host to many activities that are constantly changing. These range from homework help, to dyadic and small group interactions involving educational and "edutainment" computer games, to outdoor games and cooking. Wherever possible, these activities are organized with respect to their potential to serve as ZPDs.

Vygotsky, himself, defined a ZPD as, ''the distance between the actual developmental level as determined by independent problem solving and the level of poten-

tial development as determined through problem solving under adult guidance or in collaboration with more capable peers'' (Vygotsky 1978, p. 86).

Vygotsky also attributed to play the property of creating ZPDs. He asserted that ''in play a child always behaves beyond his average age, above his daily behavior; in play it is as though he were a head taller than himself'' (1978, p. 102).

Educational computer games, from this perspective, offer rich opportunities for creating conditions that promote learning and development both by virtue of their combination of academic and game-like aspects and because in the local culture that arises in each UC Links site, the school-like aspects of the game are carried out together with older, friendly peers who provide new sources of support and motivation. This ''partnership'' mode of organizing teaching/learning interactions reflects Vygotsky's idea that before they are able to carry out new and more complex forms of thinking on their own, the less experienced participant in a ZPD can learn about aspects of the overall problem through joint participation with a more experienced other. In this manner, from the beginning, ''future challenges'' can be experienced without failure and overall engagement in the task is increased. Over time, less experienced partners learn to take over more and more parts of the whole task until, if the process is successful, they are able to carry out the task on their own. That is the pattern that I trace out in the interactions described below.

Since its introduction to the West, the ZPD has ordinarily been interpreted as a characteristic of the individual child or youth involved, and movement through this zone as change in the novice's ability to deploy skills successfully. Moll (1989, 1990) among others has argued against this individualistic conceptualization of the ZPD. He proposed that the ZPD should be thought of as, ''a characteristic not solely of the child or of the teaching but of the child engaged in collaborative activity within specific social environments'' (Moll 1990, p. 11). This interpretation shifts our focus from the individual to the social system in which children are taught, a system that emerges in the collaborative, reciprocal activities of the teachers and students. ''The focus,'' writes Moll, ''is not on transferring skills, as such, but on the collaborative use of mediational means to create, obtain, and communicate meaning. The role of the adult is not necessarily to provide structured cues, but rather, through exploratory talk and other social mediations, to assist children in appropriating or taking control of their own learning'' (Moll 1989, p. 60). ZPDs, continues Moll, ''need not be created individually for each student; rather, they can be created collectively, as children interact with a diverse social system of instruction, with mutually supporting zones of proximal development, and continually display what they know, what they are learning, and how they are using what they know to deal with new and more advanced instructional situations. And it is in transforming new situations with the teacher's help that children actively transform themselves'' (p. 67).

The activities at UC Links sites adopt this ''social system'' approach to designing for and analyzing the teaching/learning interactions that occur between the undergraduate students and their younger peers. Of special importance is the maintenance of a long-term association between the university group and community organization that together constitute the UC Links site. Participation in the practicum classes that are paired with visits to the community site creates a situation where the undergraduates come to the site and participate for 10-18 weeks, depending upon their institution's curriculum schedule, while the children come over periods that often last for a year or even several years. As a consequence of this circumstance, it is possible

to study the potential in teaching/learning interactions when the undergraduate is not the more capable peer, but the novice, who is encountering a game or other local activity for the first time in the company of a younger, but more experienced, participant who knows the local cultural norms and, crucially, may have a great deal more experience with the games that are the media of their joint activity. This situation positions the children as the more capable peers, and so provides opportunities for the children to lead the ''less capable'' undergraduates in activities that they initially might not be able to engage in on their own. As an ensemble, these circumstances in turn create the potential for more open communication between the undergraduates and the children, which in turn can create opportunities for more collaborative interaction.

The aim of arranging social interaction at UC Links site in ways that afford collaboration and differential, heterogeneous expertise is to occasion situations for all the participants to think about learning and its interconnectedness with development in new ways. Instead of seeing learning solely in terms of what adults can give to children, researchers and their undergraduate students begin to think of learning in terms of new ways of accomplishing valued goals and as a process of emerging mutual understanding (Bremme et al. 2006). The children, in turn, begin to think of their problem solving activities as challenges that spur them to think and act more effectively (Cole/The Distributed Literacy Consortium 2006).

## 3 Methods

The analysis that follows is aimed at illustrating how the UC Links design principles described above help promote the learning and development of children participating in the program. This analysis is drawn from documentation of a history of collaborative computer game play between an undergraduate and a local youth at a UC Links site. A critical part of the analysis is derived from an episode in this history in which the undergraduate and youth successfully complete a challenging level in a computer game. By following the sequence of their interactions around the computer game they played, we are able to trace their behavior in a manner that illustrates a clear pattern in the progression of their joint activity: Initially the undergraduate begins as the less experienced peer, then becomes the more experienced peer, and in the end, relinquishes his role as the child forcefully demonstrates that he has acquired the problem solving approach that success in the game requires. In order to reach this episode, I begin the analysis with relevant background regarding the history of the relationship between the undergraduate and youth at the UC Links site. This background is based on ethnographic field notes written by the undergraduate that provide crucial information concerning the focal learning interaction.

## *Participants*

The interaction examined below involved Mark,[1] a 19 year-old undergraduate biology major, and Uri, a 9 year old fifth grader. Mark is an Anglo monolingual English speaker; Uri is a Mexican-American Spanish-English bilingual.

## *Setting*

Mark and Uri's interaction takes place in a long-running (1989) UC Links site known as *La Clase Mágica* (LCM; Vásquez 2003). LCM is located in a Mexican-American enclave of a southern California suburb. Activities at this site are structured to create a bilingual-bicultural socio-cultural environment. The bicultural character of activities is promoted not just as a source of pride for the predominantly Mexican-American youth who attend the center four days a week (vs. the mainly Anglo and Asian undergraduates who visit the site), but as a social and cognitive tool for navigating academic and cultural challenges faced by them as they make their way through the Anglo-dominated school system.

## *The Computer Game*

In the episode analyzed here Mark and Uri play *Zoombinis Mountain Rescue* (ZMR), a computer game that bills itself as a program for helping players learn "math of the information age" (Mah/Watson 2001, p. 26).[2] In the game, players engage in a series of logical problem solving tasks that are embedded in a fantasy narrative. The game is set in a fictional land inhabited by creatures called Zoombinis. In the narrative, a group of Zoombinis have become lost in a mountain range. The player is asked to lead a rescue party of Zoombinis to find the group. In order to reach the lost Zoombinis the player must solve a series of puzzles, each of which allows the rescue party to advance incrementally toward the lost group.

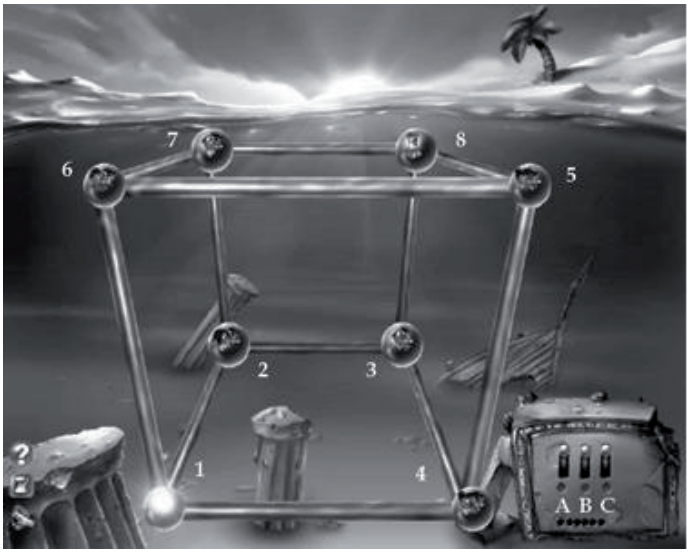
The specific puzzle Mark and Uri are playing is called the Aquacube. The player must transport the Zoombinis to an island on one side of a body of water using an underwater pipe system. The system of pipes is shaped like a cube (Figure 1). Each of the corners of the cube contains a bubble. All but two of the bubbles contain the Zoombinis that must be moved to shore. One of these two bubbles contains a white light (Figure 1, corner 1), the other contains a yellow creature known as a Fleen (Figure 1, corner 8). The object of this level is to move the light through the pipes to the bubbles that contain Zoombinis. When the light is moved to a bubble containing Zoombinis, the Zoombinis in that bubble are moved to shore; however, if the light

1 The names used are pseudonyms.

2 The game manual describes this math as the kind "that children will use in writing computer programs, solving complex problems, organizing data in spreadsheets, and searching for information on computer networks. But it is also math that children can apply to problem-solving situations in all areas of their lives, through logical thinking, experimenting, and organizing information. Zoombinis Mountain Rescue offers your child an opportunity to learn and practice these skills, as well as offering mathematical content ranging from the most basic principles of logical thinking (cause and effect, order and sequence) to concepts that are studied formally in college" (Mah/Watson 2001, p. 26).

is moved to the bubble containing the Fleen, all the Zoombinis that have been transported to shore will be lost.

Figure 1. Screen capture of the "Aqua Cube" level in Zoombinis Mountain Rescue. Numbers identifying each corner of the cube also identify the order in which Mark and Uri moved the white light (excepting number 8).




When activated using a computer track pad, levers located on the lower right-hand side of the screen (Figure 1, A, B, C) move the light in one of three pairs of directions – forward/backwards, left/right, up/down. Each of the three levers corresponds to one pair of directions. The initial task for the player is to discover through trial and error which levers correspond to which pair of directions.[3] The direction in which the light will move depends not only on the lever activated, but also on the location of the light before activation. For example, in Figure 1 the light is located in corner 1. This means that the light can only move in three of the six possible directions (i.e. forward to corner 2 if the front-back lever is activated, right to corner 4 if the left-right lever is activated, or up to corner 6 if the up-down lever is activated). The Aquacube level is challenging not only because the player has to avoid the Fleen but because the player has a limited number of opportunities to activate the levers. The six circles beneath the levers serve as indicators of the number of tries the player has left. When the player has exhausted one try, one of the circles turns red.[4]

3 The directions corresponding to each lever are randomized every time that the level is played anew.

4 The ZMR manual explains "the educational benefits" of and appropriate strategies for the Aquacube level as follows: "This puzzle has a 'guess my rule' element, challenging the player to deduce the function of each lever. Using trial and error to collect evidence is an important first step. With the first try, the only option is to guess, by pressing a lever and observing the result. When a player determines, for example, that "the first lever moves the light up and down, and the second lever moves the light front to back," one can then infer the result of pressing the third lever. Now one must plan carefully, remembering that there are a limited number of moves. Spatial reasoning is also important when observing how the light moves along the three dimensions of the cube. In the Aquacube, a player must learn to distinguish between directional paths that may appear to be very similar, but are actually along different dimensions" (Mah/Watson 2001, p. 30).

### *Methods of Observation and Documentation*

The episode examined here is drawn from a video data corpus of interactions between undergraduates and children at LCM. The corpus was generated as part of a four month, qualitative study of the role that non-verbal communication plays in the development intersubjectivity between adults and children jointly engaged in computer game play.[5]

Videos were gathered using one video camera positioned above and behind the computer monitor displaying the computer game. Screen recording software was used to simultaneously capture activity on the computer screen.

In addition to video recordings of undergraduate-student interactions, the data set included my own field notes and those written by undergraduate vistors to LCM (including Mark's) who were enrolled in the practicum during the period that the study was conducted. These field notes were analyzed for text describing (a) undergraduate experiences participating in the specific instances of game play that were analyzed; (b) prior interactions between the undergraduate and the child who participated in the game play; (c) undergraduate perspectives on learning, development, and teaching; and (d) undergraduate perspectives on the child with whom they engaged in the joint play. This field note data was gathered to build the cultural-historical knowledge base necessary for analyzing and interpreting the specific episodes of game play.

## 4 Mark and Uri's Early Interactions at LCM

In field notes written during his first three weeks at LCM, Mark wrote that Uri did not like going to LCM and that he especially did not like doing homework. Mark explains Uri's behavior in part by drawing on memories of his own childhood, writing that a child who just left school for the day would be put off by having to go somewhere else to do what that child sees as more schoolwork. Additionally, during these early weeks at LCM, Mark describes Uri as frustrated with his failures to successfully complete some video games; as needing to "get his confidence back up"; as someone who is "not the most outgoing"; as needing help focusing; as someone who rushes through his school work ("I was a little suspicious because this would be the 4th time . . ."); as someone not entirely to be trusted.

5 In the larger study from which the Mark and Uri example was drawn the strategy for documentation and analysis was as follows. Twice a week during a ten week period video recordings were made of undergraduates and children engaged in joint ZMR played. The choice of ZMR as the focal game was driven by the fact that (a) it was one of the most frequently played games at LCM by both undergraduates and children and (b) given the clearly defined problem solving tasks required to complete each of the ZMR game levels, it provided a way to assess the degree to which the undergraduate and the youth shared a situation definition (Wertsch 1984). From this corpus of video recordings I then selected examples of game play in which game levels were successfully completed. Because I was interested in examining the development of intersubjectivity, I then further narrowed the range of examples for analysis from this sub-sample by selecting instances in which the successful completion of the level was preceeded by some degree of interpersonal tension between the undergraduate and child that was noticeable in the verbal and non-verbal communication. Finally, I drew on concepts from linguistic anthropology – participation framework and interactional stances (Goodwin 2007) – as analytic tools for coding the undergraduate-child interactions to identify the tensions and their resolutions (see Lecusay 2013).

Three weeks into the academic quarter Mark's notes reveal changes in his impressions of Uri. One factor that ushered in these changes was differences in cultural knowledge between Mark and Uri. Witnessing an interaction between an adult LCM staff member and Uri, Mark learned that Uri spoke Spanish. Furthermore, Uri introduced Mark to Caesar Chavez, the famous Mexican American labor leader and civil rights activist. Mark's field notes describe these moments with admiration for Uri. He begins describing Uri as a "smart kid."

Prior to the problem solving episode analyzed from the video recording, which took place on February 14th, Mark and Uri had worked and played together on four separate occasions. On each of these occasions their interactions began with Mark assisting Uri with homework and ended with the two collaboratively playing one of the computer games available at LCM.

Relative to Mark, Uri was a ZMR expert. Uri had played ZMR before, including the Aquacube level, numerous times on his own. He knew the mechanics of the Aquacube level and the overall goal – to move all of the Zoombinis out of the Aquacube and onto the nearby island. Mark and Uri played ZMR for the first time together on February 7th. This was Marks' first time playing ZMR, and the first time that he and Uri had played the Aquacube level together.

The video record of this February 7th episode begins with Uri explaining to Mark that the Aquacube level is "the hard part." He tells Mark that the last time he played this level he reached a point where he simply gave up and skipped over it to the next level. (In ZMR players have the option of cutting their losses and moving onto the next level).

Quitting and skipping ahead in the Aquacube level involves leaving behind the Zoombinis that have not made it to shore; this action will eventually result in losing the game. At the first sign of failure Uri attempts to skip this level, but Mark encourages him to continue and complete the level despite Uri's noticeable frustration. Mark also appears frustrated. Not only does he initially have trouble establishing the goals and mechanics of the unfamiliar game, but he has difficulty getting Uri to persist in completing the level.

The video record of this February 7th episode also shows clearly that Uri has an accurate understanding of the mechanics of the game which he demonstrates to Mark: he understands that each lever corresponds to the directions of movement for the light as well as the important information that the red lights below the levers indicate the number of turns left to complete the task. These observations provide the context for the critical session to follow.

## 5 Analysis of Collaborative Game Play

I now examine the February 14th episode in which Mark and Uri collaborate to successfully complete the Aquacube level. Studied as a process of negotiating a common ground of engagement (Matusov 1996), the interaction unfolds in a series of discrete segments.

Segment 1: Explanation before Action

Just prior to Uri making his first move, Mark comments that "we gotta figure out what the levers do" and asks him what the lever he plans to activate (lever A) is "gonna do?" Uri does not verbally answer, but upon activating lever A he "responds" by performing a hand gesture that emulates the movement of the light (front to back). Mark simultaneously performs a similar gesture and remarks with some emphasis, "okay, that one moves you this way."

With Uri poised to activate lever B, Mark asks him to consider what the lever might do. Again, Uri does not reply but simply activates the lever. This move also leads to the rescue of two more Zoombinis.

Segment 2: Learning Strategy vs. The Next Best Move

With the light now positioned in corner 3 Uri has to proceed with more care than he did in his prior two moves. If Uri selects lever C, the only lever he has not yet activated, the light will move to corner 8 where the Fleen is located. This move would result in Uri loosing all of the Zoombinis he has rescued so far. Mark quickly intervenes, commenting on the function of lever C ("that one's gonna move you up"). Modeling the kind of deductive reasoning that the Aquacube level of ZMR is designed to promote, Mark then retraces the trajectory taken by the white light on the computer screen while saying – "remember, we've already gone this way . . . and we've already gone this way … so the last direction you're able to go is what?"

Although Uri does not verbally respond to Mark's reminder and prompt, he does perform gestures that suggest he knows, correctly, to move the light to corner 8. However, Mark is not asking him for the next best move. He is trying to orient Uri to the larger goal of deducing the function of all three levers ("the last direction you're able to go is what").

Uri and Mark's actions throw into relief the different approaches that each is taking toward the game – they do not wholly share a "common ground of engagement" (Matusov 1996). Mark is focused on teaching an overarching strategy, one that from his perspective requires Uri (a) to exert enough self-control to (b) stop and consider the directionality of each lever and (c) to apply this understanding to selecting the most appropriate lever. Uri on the other hand appears to be operating on the basis of (a) establishing the location of the light and (b) determining the next best corner to move to without stopping to think through the consequences.

Segment 3: A Change in the Structure of the Problem Solving Activity

In the following segment Mark improvises a short lesson to help Uri "discover" the function of lever C. Mark begins to construct an imaginary 3-D model of the cube on the table in front of the monitor by using his fingers to retrace the trajectory taken by the light in the game thus far:

Having retraced the light's trajectory up to corner 3 in the imaginary off-screen model of the cube,

Mark now stops his right index finger at corner 3 and, as he did when he was using the screen as a point of reference, asks Uri the same question he did earlier: "what's the last direction you can go?" Once again, Uri does not answer verbally but ambiguously moves his arm upwards while simultaneously moving it from side to side. Mark's question, however, was rhetorical. Before Uri can complete this ambiguous gesture Mark cuts in and answers the question himself ("up 'n down, right?"). After this, Mark confirms with Uri that he understands the consequences of moving the light to corner 8. Uri correctly tells him that this would "kill all" of the rescued Zoombinis.

By leading Uri in jointly producing an imagined model of the cube, Mark changes the joint focus of cognitive and visual attention (Goodwin 2000), and potentiates a new way of understanding the activity. This change in the conditions for how Mark and Uri align their understandings has a number of consequences for how they subsequently coordinate with one another and for how Uri begins to change the way he plays the game. First, Mark's use of a gesture-based, imaginary 3-D model of the problem shifts Uri's attention from the screen – what has been the shared point of attention for the prior twenty minutes of ZMR game play – to a new point of shared focus. Through this attentional shift Mark focuses Uri's attention in a new way. Now the task becomes one not only of remembering the trajectory taken by the light, but of using this information as a basis for assessing consequences in the game on the screen. Uri joins Mark in comparing the information "displayed" in the ephemeral, off-screen gestural model to the information on the screen itself. It is also significant that as an abstraction of the game space, the off-screen model offers both a consequence-free space for testing theories about the state of the game and helps to focus attention on those aspects of the game relevant to Mark's attempts to get Uri to reorganize his game play more thoughtfully. Lastly, by creating the off-line model himself, Mark gains control over the actions in "the game," that is, he has greater control over his modeling of self-control in the imagined space he is making than when Uri has control of the computer mouse.

Critically, at this point Uri displays cooperative alignment with Mark. He does this not only by maintaining his gaze on Mark's hands as Mark "draws the model" through his gestures, but he also uses the imaginary off-screen model to assess the consequence of activating Lever C in the computer game itself.

Segment 4: Transfer of Responsibilities – Uri thinks before he acts

In the final segment of this episode, Mark and Uri collaborate to successfully complete the level. Throughout most of this final segment Mark continues his pattern of intervening immediately after Uri has activated a lever, using known-answer-questions to emphasize aspects of the game to be considered before proceeding (e.g. "which [lever moves] across"; "how do we [move the light] down there").

Mark's pattern of behavior makes it difficult to assess whether Uri has himself adopted the "think before you act" approach because Mark's verbal actions take up the conversational turn immediately after the activation of the lever – the temporal point best suited for Uri to articulate this approach. However, after several repetitions of this pattern, for the first time, Uri seizes the turn after the activation of a lever. Rather than simply activating a lever as he had done in prior turns, Uri first

verbally describes the next move ("and then we want to go up"), gets confirmation from Mark, and then correctly activates lever C.

Significantly, one move later, Uri again checks with Mark before making his move. Critically, he asks Mark for confirmation about the functionality of the lever he plans to activate. Uri correctly points to Lever C, get's verbal confirmation from Mark, and activates the lever. Success!

## 6 Discussion and Conclusion

My aim in presenting the analysis of Mark and Uri's collaborative game play was to provide a "close up" illustration of the interactional processes that underlie observable characteristics of extended learning settings promoted by researchers and practitioners as instrumental to creating quality education. Taking, for example, qualities outlined in the recent *Youth Program Quality Assessment Validation Study* (Smith/Hohmann 2005), we see that Mark and Uri's interaction took place in a *supportive environment* populated with staff that were *welcoming*, *encouraging*, and which helped youth *build new skills*. This was also an environment in which youth had opportunities to *participate in small groups* and *partner with adults*; an environment in which youth could *make choices based on their interests,* had opportunities to *reflect,* and could *set their own goals and plans*

What my analysis throws into relief is the engagement in academically and socially valued modes of thought and disposition (Greeno/Gresalfi 2008) that occurs when UC Links principles are used to design quality after-school education. Important in this respect is the way that multiple activities – organized within a multigenerational settings – create myriad opportunities for high quality interactions that have so many of the properties of a ZPD.

Recall Moll's proposal that we understand that ZPDs, ''need not be created individually for each student; rather, they can be created collectively, as children interact with a diverse social system of instruction, with mutually supporting zones of proximal development, and continually display what they know, what they are learning, and how they are using what they know to deal with new and more advanced instructional situations" (p. 67). The idea of a diverse social system of instruction is key here, particularly the recognition of the need to attend to the specific characteristics and needs of the social environment in the design, implementation and study of after-school activities.

As Nicolopoulou and Cole (1992) noted on the basis of their work in another Fifth Dimension site, UC Links activities that follow the model of the Fifth Dimension and LCM are organized to create and maintain *cultures of collaborative learning*. These cultures involve the creation of make-believe worlds constituted by a system of shared rules. Children's taking an active role in their own education is facilitated through their understanding and acceptance of this system of shared rules. Most critical for our purposes here, it is important to understand the role of the undergraduates in this context: "They are there to guide and facilitate the children's development—not to act as authoritarian figures or simply to serve as sources of information in a one-way transmission relationship" (Nicolopulou/Cole 1992, p. 292).

It is no accident that there is significant overlap between those characteristics commonly identified with successful after-school programs and the basic principles of a culture of collaborative learning. Uri and Mark's interaction, considered as an instance of a culture of collaborative learning in action, shows how these principles and characteristics support one of the key tasks in achieving quality teaching-learning: successful negotiation of a common ground of engagement between interlocutors in an instructional interaction.

What were Mark and Uri negotiating? What did it take for this negotiation to succeed? With respect to what was being negotiated, we need to consider the hybridity afforded by the culture of collaboration. In this case, the hybrid is between:

1. The formal and informal approaches to game play that Mark and Uri brought to the table.
2. Mark's systematic "think before you act" approach and Uri's trial-and-error approach.
3. Mark's background – an older and admired university biology major – and Uri's background – a Latino fifth grader, bilingual in English and Spanish.

Mark was intent on teaching Uri how to play Zoombini's *systematically*. No one told him that he had to teach Uri, only to be a friendly, older peer who had a lot to learn himself. He wanted Uri to understand the overall logic of the game and to draw on this logic to strategize his subsequent moves in advance. Like most undergraduates new to a UC links site, Mark's default approach to helping Uri was colored by his many successful years of classroom experience.

Mark's dominance over the bulk of the interaction is manifested through his adoption of the conventional initiation-response-evaluation mode of triadic instructional discourse (Cazden 1988; Mehan 1979). At times, from my perspective and that of anyone who implements a UC Links program, Mark's reliance of this way of organizing his collaboration with Uri actually might have impeded the course of events. Indeed, Uri's struggle to communicate with and understand Mark highlights the fragility of the situation. But in the end, Uri breaks Mark's overly-instructional routine and demonstrates that he has acquired the desired skill and disposition.

Additionally, one could argue that by deploying this form of discourse Mark was seeking verbal confirmations to his queries as evidence of Uri's understanding. As we saw, however, it was primarily through physical gestures or actions in the computer game that Uri initially communicated his understanding of, and approach to, the game. This disjuncture between Uri's actions and Mark's expectations produced sufficient confusion and tension to lead Mark to perform his improvised remediation of the activity (the gestural production of the Aquacube). And this unusual, spontaneously generated, mode of interaction in turn reoriented Uri away from simply playing the game in a trial-and-error mode and toward focusing on understanding and implementing the functionality of each of the three levers in order to play the game successfully. This transformation was reflected in the change in Uri's engagement with Mark, a change from engaging primarily with the game – thinking through acting on the game – to engaging with Mark to think about how to play the game (e.g. externalizing his thinking as a way to verify with Mark the accuracy of his intended moves). Tellingly, Uri's externalization of his thinking functioned not only as a form of self-regulation but also as a means of disrupting Mark's dominating pat-

tern of intervening each time Uri made a move in the game. In other words, whereas the agency resided largely with Mark in the beginning of the episode, by the end of the episode it was clearly Uri's.

With respect to the question of what it took to successfully negotiate Mark and Uri's formal/informal divide, we have to consider why it was that Uri and Mark stuck it out – why, despite all the frustration and confusion that emerged in the combination of the formal and informal in Mark and Uri's game play, they both continued to voluntarily participate in the activity. The key here is the fact that Mark and Uri had a history of affiliation, play, and work together at LCM. They also had a specific history of playing Zoombinis together, and this history included instances when Mark was more expert at certain activities than others (e.g. thinking formally about Aquacube game play), and instances in which Uri was more expert than Mark (e.g. Uri explained the mechanics of the Aquacube to Mark when he first encountered Zoombinis).

Finally, the Aquacube session highlights the potentially important role that games like Zoombinis can play, under the right circumstances, in promoting learning in after-school environments. As the episode with Mark and Uri illustrated, computer games can function as tools to occasion situations in which an expert isn't required in order to teach students useful things. The games mediate between college students with their relative expertise of academic culture and the after-school youth who are experts in the local culture. These games can be key to creating a "smart context" (Barab/Plucker 2002), which is another way of characterising a zone of proximal development.

## References

Barab, S. A./Plucker, J. A. (2002). Smart people or smart contexts? Cognition, ability, and talent development in an age of situated approaches to knowing and learning. *Educational Psychologist, 37*(3), 165–182.

Bremme, D./Blanton, W./Gallego, M./Moll, L. C./Rueda, R./Vásquez, O. (2006). The dynamics of change in children's learning. In: M. Cole & the Distributed Literacy Consortium (Eds.), *The fifth dimension: An after-school program built on diversity* (pp. 107–128). New York: Russell Sage Foundation.

Brown, A.L./Campione J. C. (1990). Communities of Learning and Thinking, or A Context by Any Other Name. *Developmental Perspectives on Teaching and Learning Thinking Skills*. Contrib Hum Dev. Basel, Karger, 21, 108–126.

Bruner, J. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.

Cazden, C. (1988*). Classroom discourse: The language of teaching and learning. Portsmouth*, NH: Heinemann.

Cole, M./The Distributed Literacy Consortium (2006). *The fifth dimension: An after-school program built on diversity*. New York: Russell Sage Foundation Publications.

Eccles, J./Gootman, J.A. (2002). *Community Programs to Promote Youth Development*. Washington, DC: National Academies Press.

Goodwin, C. (2000). Practices of Color Classification. *Mind, Culture and Activity*, 7(1–2), 19–36.

Goodwin, C. (2007) Participation, stance and affect in the organization of activities. *Discourse & Society,* 18(1), 53–73.

Greeno, J. G./Gresalfi, M. S. (2008). Opportunities to learn in practice and identity. In: P.A. Moss/D.C. Pullin/J.P. Gee/E.H. Haertel/L.J. Young (Eds.), *Assessment, Equity, and Opportunity to Learn*. New York: Cambridge University Press.

Jones, J.N./Bench, J.H./Warnaar, B.L./Stroup, J.Y. (2013). *Participation as relational process: Unpacking involvement in Social action and Community Service*. Afterschool Matters.

Lecusay, R. (2013). *Telementoring Physics: University-Community After-school Collaborations and the Mediation of the Formal/Informal Divide*. Unpublished dissertation. University of California, San Diego.

Mah, C./Watson, A. (2001). *Zoombinis Mountain Rescue User's Guide*. Novato, CA: The Learning Company.

Matusov, E. (1996). Intersubjectivity without agreement. *Mind, Culture, and Activity*, 3, 25–45.

Mehan, H. (1979). *Learning lessons: Social organization in the classroom*. Cambridge, MA: Harvard University Press.

Moll, L. C. (1989). Teaching second language students: A Vygotskian perspective. In: D.M. Johnson/D.H. Roen (Eds.), *Richness in writing: Empowering ESL students* (pp. 56–69). New York: Longman.

Moll, L. (1990). Introduction. In: L. Moll (Ed.), *Vygotsky and education* (pp. 1–27). Cambridge, MA: Cambridge University Press.

Nicolopolou, A./Cole, M. (1992). Generation and Transmission of Shared Knowledge in the Culture of Collaborative Learning: The Fifth Dimension, Its Play-World, and Its Institutional Contexts. In: E.A. Forman/N. Minnick/C.A. Stone (Eds.), *Contexts for Learning: Sociocultural Dynamics in Children's Development* (pp. 283–314). New York: Oxford University Press.

Papazian, A. E./Noam, G. G./Shah, A. M./Rufo-McCormick, C. (2013). The quest for quality in afterschool science: The development and application of a new tool. *Afterschool Matters, 18,* 17–24.

Rogoff, B. (2003). *The cultural nature of human development*. New York, New York: Oxford University Press.

Smith, C./Hohmann, C. (2005). *Full Findings From the Youth Program Quality Assessment Validation Study*. High/Scope Educational Research Foundation.

Vásquez, O. A. (2003). *La Clase Mágica: Imagining Optimal Possibilities in a Bilingual Community of Learners*. New Jersey: Laurence Erlbaum Publishers.

Vygotsky, L. S. (1978). *Mind in Society.* Cambridge, MA: Harvard University Press.

Wertsch, J. V. (1984). The zone of proximal development: Some conceptual issues. In: B. Rogoff/J.V. Wertsch (Eds.), *Children's Learning in the Zone of Proximal Development* (pp. 7–19). San Francisco: Jossey-Bass.