

# The Continuity and Transformation of Learning Strategies and Goals in Children's Activities across Settings and Tasks

Kim, Rae Young<sup>1)</sup>

## Abstract

The purpose of this article is to investigate the relationship between children's goals and activities in terms of continuity and transformation of their learning through interactions between learners and practices across settings. By observing children's activities across settings and tasks and interviewing the children, I found that the continuity and transformation in learning are developed in the relationship between changing individuals and changing social context. In this process, social interaction with others plays an important role in changing their goals and strategies. The results imply that appropriate tasks and teachers' guidance are crucial to facilitate students' learning across settings.

Key Word : Emergent goals, Continuity, Transformation, Social interaction

## I. Introduction and Theoretical Foundation

The purpose of this article is to investigate the relationship between children's goals and activities in terms of continuity and transformation of their learning through interactions between learners and practices across settings: Is there continuity in children's learning through different tasks and activities across settings? How do children develop continuity and transformation in their learning across settings? How do children learn and change their goals and activities through interaction with others, including their peers and I (the researcher)?

Leontiev (1978) considers the effectiveness of goal-directed activities as a means for understanding the intertwinement of cultural, social, and cognitive processes. He defines three levels of activities: activities that occur in relation to motives; activities defined by the goal; and activities of operations. Overall, he thinks that motives and goals reinforce

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1) Ewha Womans University ([kimrae@ewha.ac.kr](mailto:kimrae@ewha.ac.kr))

both cultural activities and the cognition that occurs within them.

However, he could not articulate the relationship between activities and settings. By means of observing the arithmetic in grocery shopping, Lave (1984) claims that an activity is dialectically constituted in relation to the setting: each creates the other and both exist at the same time.

Recently, the importance of goals is stressed as a mediating connection among society, culture, and the process of thinking. Saxe (1991) creates a four-parameter model that explains how emergent goals are formulated and changed. He thinks that emergent goals, as a central focus, are not static but changeable in several ways in which are influenced by the dynamics of an activity, including social interactions between those engaged in a practice; the organizational structure of a practice; individuals' prior goals and understandings; and artifacts, norms, and conventions of the practice. From this point of view, he generates a framework to explicate emergent goals in relation to the four elements: activity structures, prior understandings, social interactions, and conventions artifacts as shown in Figure 1.

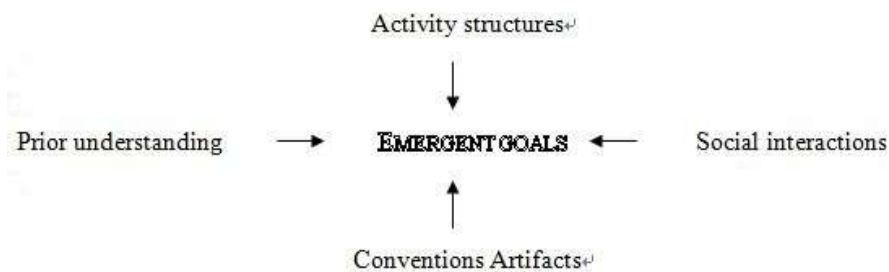


Figure 1. Four-parameter model

In particular, through the changing practice of economic exchanges in the Oksapmin community, Saxe (1999) establishes a framework for understanding the dynamics of cognitive development in collective cultural practices using the interplay between microgenesis, ontogenesis, and sociogenesis: through “sociogenesis of cultural forms,” individuals create new forms for “microgenetic schematization” that turn into the foundations for new ways of engaging in practices and the seeds for subsequent “ontogenetic changes” in knowledge. In applying his theory to my study of children’s activity, changing practices engender the needs for children to create new goals and new cognitive development in order to achieve these goals.

As an illustration of an investigation of the relationship between goals and settings, Beach (1999) argues that consequential transition involves a developmental change in the relation between an individual and one or more social activities. He considers continuity and transformation in learning as an ongoing relation between changing individuals and

changing social contexts. He also argues that these transitions are consequential when transitions are consciously reflected on and often struggled with and when the final outcome changes one's sense of self and social positioning. However, consequential transitions can be understood not only by the relations between individuals and activities but also by activities in themselves as developmental entities. In addition, since the relations between various types of activities are not neutral or simply additive for individuals participating in them, it is necessary to think the "leading activity" at a given stage which is more important for the individual's subsequent development.

I thus focus on the continuity and transformation of the children's learning across settings and tasks based on the four-parameter framework of Saxe (1999) and on the changes of their goals and learning through interactions across activities. My conjecture is that my interventions also help them to renegotiate their goals and the leading activity as well as being a catalyst to create new knowledge and new strategies. Through this process, the children's conceptual understanding can be transformed, continued, and developed across settings and tasks.

## II. Methods

In order to investigate children's learning across settings and tasks, I observed a group of two 10 year-old boys (B1 and B2) and two 10 year-old girls (G1 and G2) in two different settings: Boys & Girls Club (hereafter called BGC) and Chuck-E-Cheese's (hereafter called CEC). At the beginning of this experiment, I interviewed the children as a group and an individual in order to explore their initial goals and their conceptual understanding from playing games in BGC. I asked them to bring their most favorite game and to explain why they liked it; how to play the game; and with whom they played the game, and so on.

Then, in order to see the changes in their cognition, I showed them two kinds of activities: frequency-based activity and area-based activity with regard to probability. In BGC, the former was the Galton board and the latter was throwing coins on the designed figures that were related to probability. Galton board, similar to "Pachinko," is a game on which the player predicts which bin the ball would fall into before dropping a ball from the top of the plane (See Figure 2). This game is made up of a pyramid-shaped staggered array of pins on a plane, with balls are dropped in at the top and forming a frequency distribution in collection bins at the bottom over many trials. The children were asked to make predictions about where a ball might land, and the distribution over many trials might help them make a more accurate prediction.

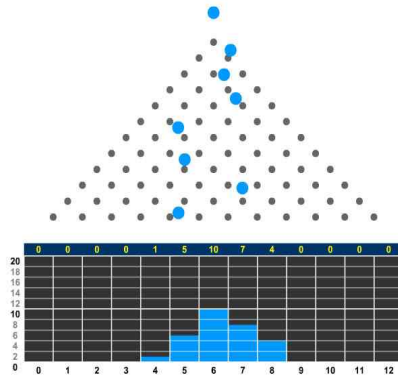


Figure 2. Galton Board

For the area-based activity, I showed the children one square that was divided into four equivalent squares as Figure 3 is shown in order to see how they thought possibility based on the area. In order to see whether different location of the object could affect their understanding of probability, I showed them two kinds of pictures as Figure 4 is shown: one circle in the center of the plane and the other circle that is located around the edge of the plane. I observed how the children thought fairness and probability when coins were dropped on the plane.

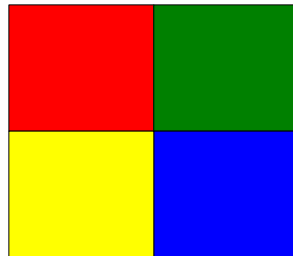


Figure 3. Area-based activity: the squares that have equal area



Figure 4. Area-based activity: changing location of circle

In CEC, I observed how the children played games. The children could select games

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that they wanted to play, and I asked probing questions about their aims and strategies from time to time. These questions were asked not only to see their current aims and strategies but also to observe their changes of goals and their learning by my interventions and their practice. The games in CEC provided tickets according to the points that players earned. Thus, if children changed their strategies or aims and they were successful to earn good scores, it could be rewards for their good performance by providing more tickets.

After this observation, in BGC, I returned to the games again. But at this time, I suggested that the children created their own games as an 'owner' and played as a 'customer' in order to see what they learned through their experiences before and how they connected their learning with social situational contexts by observing the design of their own games regarding to fairness and likelihood.

In addition, for the purpose of examining the effects of interaction with peers during the play, I also observed one girl who was not in the group but of the same age with the children of the group who I observed previously. I provided the same tasks in the same settings as those of the group. I examined if she played without any interaction with peers, how different her way of learning was from that of the children's learning, how she built up her goal, and how she changed her goals through playing games across the settings.

During the observation, I was not only observing the children's activity, but also asking questions and interviewing them according to their responses so that I could also help them renegotiate the leading activity as Beach (1999) asserted and see how they changed their goals or aims of engaging in the activity by our intervention and their learning through practices. Research questions are shown as followed:

1. What are the children's goals and how are they different across sites and tasks?
2. How do the children's interactions with others affect their learning and changes in their goals?
3. How are the children's cognitions changed across tasks?

In the remaining sections of this article, I first describe what the children's goals were and how they changed through interactions with their peers and I as a group, compared with the case of one student's goals in the same settings. Next, I describe what the children learned; how they learned it through this process; and the relationship between their goals and activity, especially through the sequence of their learning with two kinds of tasks.

### **III. Goals and Changes In the Goals Across Activities and Settings Through Interactions**

Initially, the motives of the children to play games were “having fun.” When I asked the children in BGC why they played their favorite games, all of them answered “for fun” as the reason for playing the game even though each picked up different kind of games respectively (they disagreed with each other on which game was fun). They also seemed to have a lot of confidence in playing their favorite game and focused on the “for fun” factor rather than “to win” as a reason to play.

Interviewer (hereafter “I”): Is it important to win?

B1: No. It is good to win though.

Although everybody agreed on the reason for playing games, each responded differently about which game was his or her favorite. From the children’s responses, I found that children’s goals emerge depended on their history with the practice. Thus, they had different thoughts and feelings, even when two children were talking about the ‘Clue’ game as below.

Talking about G2’s favorite game (Bingo):

B1: That game is boring.

Talking about B1’s favorite game (Clue):

I: When you started, was it difficult?

G2: That’s boring.

B1: Not really (difficult). Bingo is boring.

G2: It (B1’s favorite) does not have tally. It has nothing.

B1: Does bingo has tally?

G2: You know what I mean!

Even though they agreed with each other that their goal for playing games was to “have fun,” their different responses to the same game showed that this goal was related to their experiences through practice such as the degree of difficulty they felt, and the results they expected when they played it. In other words, the emergent goal is associated with individual’s prior understanding or knowledge, conventions, and the activity structures. This statement corresponds to Saxe’s framework that I mentioned in the introduction. For instance, when the boys played the Skee-ball game (Figure 5) in CEC, they reflected on their experiences at school playing the game. They were better at playing the similar game which they have already experienced at school. Thus, they could feel more fun from this game.

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Figure 5. Skeeball game

In CEC, as soon as I arrived there, the children chose “Tunnel” where the children crawled inside and found the exit by following others or catching each other. Even though this game was not competitive and there was no winner, they seemed to be very excited and to have fun. However, when they faced other games, they were not sure how to play, even though they had already played the games in CEC. Nobody read the instructions before playing. Instead, they just tried pushing buttons or hitting the punch without skills or getting information on how they could get tickets or points.

For example, G2 played with the Yo-Yo punch, a game to match the given number with how many times the spin would swing by controlling the force of punch. However, she did not read the instructions and just punched without waiting for the yo-yo to get in the right position. She was able to get some ideas at the second or third time but she could not understand that going away over the number was not as good. Nevertheless, she said, “I got it closer” and was satisfied with the result because she got a lot of tickets from the game. Then, she said, “This is fun.” After all, she could not recognize the rule of the game and was not really interested in what she could do to get more tickets. In the new game that the player had not experienced before, the goal of “having fun” was not enough motivation to continue playing the game as long as the player did not receive any reward or feedback from the game.

Nonetheless, G2's attitude changed after comparing the number of tickets she got with G1's and the others' number of tickets. Her criterion of whether she felt the game was fun or not was the number of tickets she got rather than the fun itself from the game. She began to play the game to get more tickets than others and would repeat playing the game if she could get a lot of tickets. This change of their goals for playing the game was observed among the boys.

B2: They (the star wars game) didn't give me tickets.

B1: Why didn't?

B2: This is one of those games that don't give tickets. I'm going to find a game that gives tickets.

Their initial goals seemed to have changed into a new goal, which was to get more

tickets. Consequently, the children paid more attention to comparing their own performance to that of their peers rather than comparing their own present and previous performances. However, they did not have any clear idea of the relationship between tickets and scores because they did not read instruction of each game. Usually, most of the games provided tickets according to the score range. For instance, if three tickets were provided for the score from 100 - 150, the player who got 105 and the player who got 150 earned the same amount of tickets. Nevertheless, they did not know this fact until the end of the game. They also did not try to figure out how to gain good scores to get more tickets. In fact, the number of tickets seemed to be more palpable to compare with others' than scores because each game had different score range and criterion for giving scores. Tickets could be a new way of measurement to show the degree of their achievement, whereas scores were difficult to compare with.

Their preference for tickets is also related to the reward they get: they can get the presents according to the number of tickets, not scores of the games. Therefore, they seemed to pay more attention to tickets without recognizing the relationship between the number of tickets and the scores as illustrated above in G2's Yo-yo punch example.

The children began to develop their own strategies for achieving their new goal of getting more tickets. However, they then faced new conflicts and challenges in playing games. Certain games, such as Skee-ball, target shooting, and basketball free throw, involved two conceptual systems: optimization and skills for the games. The children needed to make decisions on which one would better: difficult targets that give higher scores or easier targets that give lower scores. In every trial, the player had to make decisions on which target to aim for. For example, in case of Skee-ball, as shown in Figure 6, the two 100,000 point targets at the upper corners were the most difficult.

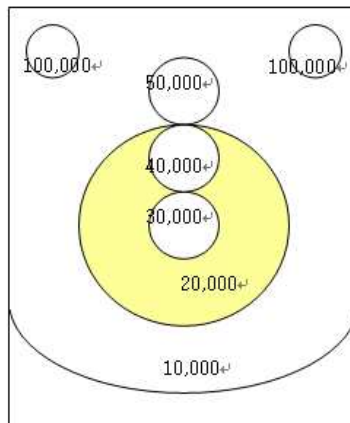


Figure 6. The scores for each area in Skee-ball game

If the player misses the 100,000-point targets, the ball is more likely to fall into the



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10,000-point target due to the structure of this game. The player is going to lose 90,000 from his or her original target. In contrast, if the player aims at 30,000 or 40,000 points, missing the target will result in a relatively small loss from the expected scores because the ball will fall into the 20,000-points target causing a loss of only 10,000 or 20,000 points due to the structure of this game. In this case, the player cannot expect to earn the highest scores. Therefore, in this game, this optimization is very crucial for the children in making decisions on which choice is more reasonable to achieve their goal.

At the beginning of this game, the girls focused on the 100,000 - point targets (the highest score) because their desires to get more tickets increased by comparing the number of tickets they had got up to that point with others'. Nevertheless, after throwing a few balls that aimed to 100,000 targets, they felt the needs to change their targets because they learned how hard it was to put the ball into the 100,000 targets. For instance, at the beginning of the game, G2 did not change her goal of 100,000 targets for a while, even though she figured out that the ball would easily go into the 10,000-point target if she missed the 100,000-point target. After several trials and our intervention to make her think about this situation, she changed her aim to 50,000 and said, "it is easier but it is complicated." After this shift, she also talked about how many tickets she got from Skee-ball. She did not seem to know why it was hard to get scores from 100,000 targets. She was not likely to recognize the area-based probability in this game.

In contrast, the boys' actions were different from the girls'. They have already had experiences playing this game or some similar games at school. Even at the first trial, they aimed for the middle rather than 100,000-point target. They seemed to think that to get 100,000 points was harder than 50,000 or 40,000 points due to the location of the target.

I: Was it hard to get the 50,000?

Boys: It wasn't hard to get the 50,000 but not the 100,000.

I: Why is it hard?

Boys: It's in the corners. It was hard to get the 100,000.

I: It was hard to get because it was in the corner?

Boys: All the ones in the middle are easy.

They did not understand that this problem was related to area-based probability. However, they seemed to get a sense that the probability of them landing into the 100,000-point targets which was the smallest targets among them was smaller than that of other targets.

I: Which one should be worth the most points, which one the least?

Boys: That one (100,000) should be the most, it's harder to get it in.

Boys: If you miss it, it just rolls in. It was hard to get the 40,000.

10,000 was the easiest because if you miss it, it will roll in.

Consequently, their goal to earn more tickets intrigued them to acquire new knowledge such as physical movement, the structure of each game, and probability. Their increasing experience created new mathematical goals of “optimization.” They developed their own strategies in order to achieve their new goals based on their prior experience and participation in this game.

In order to facilitate achieving their goals in Skeeball, the children seemed to focus on and consider carefully their skills of playing the game such as the force of throwing the ball. They also changed their strategies as they learned how to play the game better. First, one of the boys tried to put the ball directly into the target but after a few trials, he changed his ways of throwing the ball by bouncing the ball from the sill in front of the targets.

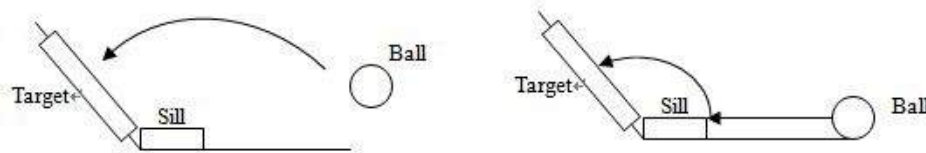


Figure 7. Change in strategies

The change in the child’s strategy obtained through their repeated practices in this game was to increase the accuracy by making the distance and duration of the ball’s flight shorter. This shows that the children developed their knowledge or skills based on reflection their prior experiences and/or understanding. In the end, the children’s efforts to achieve their goal created new strategies and knowledge, which led to learning from the experience. Increasing participation in playing the games led to new goals and new strategies. This is consistent with Nasir (1999)’s claims that learning creates goals and vice versa. Nasir (1999) also argued that these goals and learning are also closely connected with one’s identity so that identity creates goals and learning, in turn, and goals and learning also create shifts in identity. She explained that new knowledge or goals, on one hand, support the construction of a more engaged and increasingly identified identity. On the other hand, stronger identity also motivates new learning and developing new goals.

This statement is also useful in this experiment. At the beginning of this observation, the children’s goals were “to have fun” from games as their answers in BGC that they played games for fun even though it had no rewards like tickets. Through interaction with others and increasing participation, the goals changed into “getting more tickets.” In order to achieve this goal, the children needed to generate new strategies and new aims in the game, which were also a form of learning for them. This changes caused the children to be more engaged in the practice and as a result, they could have

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stronger confidence in this practice as being an expert. They felt that this game was easy and they had fun in this practice.

Eventually, while the goals changed from having fun to getting more tickets and again to having fun, the children set up subsequent goals (e.g. changing their targets in Skee-ball) for achieving the main goal (e.g. getting more tickets) and moved toward the goal. If their action was not effective, they adjusted their actions. Through this process, they learned and created new goals.

At this point, I defined internal goal as the emergent goal from the tasks or player such as "having fun" and external goal as the emergent goal from external factors such as getting higher scores or getting praise.

Since the two kinds of goals were very closely related to each other, these processes could be sequential and interrelated as Figure 8 was shown.

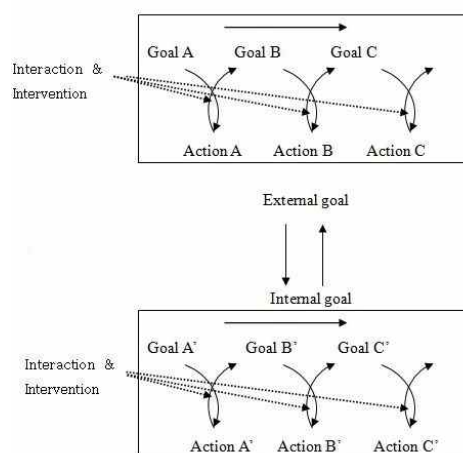


Figure 8. The shifts of goals

Through this process, the children could develop a stronger confidence and affirmative identity in the practice and the kind of game that they felt to be easy or fun could differ because of different experiences, understandings, identities, prior experiences and so on. In the next section, I will describe the children's interaction with others and its effects on their learning during this process.

### IV. Effects of the Children's Interactions With Others on Their Learning and Their Goals

In view of social learning theories, facilitative effects of child-child interaction on learning were interpreted in terms of the processes of imitation or modeling (Light & Littleton, 1999). This theory is set against the Piagetian constructivist explanations that they regarded as an excessively individualistic emphasis. Although Piagetian

constructivism showed that children who initially performed at 'pre-operational' levels on tasks could be led to operational judgments on such tasks by being required to observe another child who offered such judgments, it was not persuasive with respect to whether the children could justify or generalize these 'operational' judgments.

In contrast, Vygotsky considered learning as a process that depends on mediation by social, cultural and institutional processes at multiple levels. He also regarded the development of higher mental thinking, reasoning and understanding as a social rather than individual process. He thus saw the appropriate interpersonal interactions as an ongoing between the learner and a more capable "other." Consequently, his approach emphasizes the way in which a shared understanding can be reached at "mutual construction," whereas a Piagetian approach points out a socio-cognitive conflict can do for individual cognitive development.

In this study, I investigate the children's interactions with peers and interviewers in terms of both perspectives. In order to see the patterns of child-child interactions, I also observed one girl (hereafter called Nancy)'s activity in CEC who was at the same age with the children I observed. At the beginning of playing games in CEC, Nancy seemed to act just like the group of children. She was also very excited and tried to engage in the activities actively. She stated that the reason for playing games was "to have fun" as well. Although she also had experiences in playing games in CEC and had the same goal for playing games at the beginning, I found some differences in her learning and actions from those of the children as a group I observed.

Even though Nancy was likely to have more conceptual understanding of area-based probability than the children in the previous section, there were little shifts in her strategies and understanding. However, the shifts were steady. Her initial goal did not change for a long time whereas the other children's goal was shifted very easily through interactions with peers and our intervention. She did not care about how many tickets she earned or how to play more effectively to get higher scores as different from that of the other children. She seemed to play games for fun and attempt to play new games. It took longer than the children in the group to change her goals for playing games from "for fun" to "getting more tickets." Festinger (1954) emphasized the power of social comparisons in practice where individuals have no reliable objective standard to use in judging themselves or their performance. The social comparison with peers were not only facilitators for their performance but also the way to "evaluate the potential" (Cottrell, Wack, Sekerak, & Rittle, 1968, quoted from Light & Littleton, 1999) of others and reflect their own performance. It seemed that the interaction had a mutual effect on other factors within goal and learning.

When Nancy played games in CEC, she did not read instructions to see how to play and only played or two times for each game. She attempted to push the buttons or hit the punch without any attention how to play. She had no resources to learn how to play the game except her prior experiences in CEC. Sometimes she read instructions when she had no intuition about how to play a certain game, but she did not refer to

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them seriously to play the games. For example, in the game needed to catch the light that moved along the circle, even though the location of light was very important to get more tickets, she pushed the button and just was happy to catch the moving light regardless of the location of light. She just tried several games only once or two times without thinking about what was important in playing the games or how to get scores.

This was the same phenomenon I observed with G2's Yo-yo punch game in the previous section. G2 had no criterion to evaluate her performance. Nancy did not have a criterion to evaluate her performance in Skee-ball, either. Nancy initially aimed for the 100,000-point target. Even though all the balls she threw went into 10,000, she kept her aim until I asked her to reconsider her strategies to get more tickets. Actually, the girls in the group learned from the boys how to play by watching them play. In this way, the girls in the group were able to use the bouncing skill immediately whereas Nancy who played alone had not tried the skill in the game.

Nancy showed more engagement in this game only if she received encouragement from me or earned a lot of tickets from the change of her aim. After several trials, she changed her aim into 50,000 but sometimes she still wanted to attempt 100,000 targets because of her desire to get more tickets. It seemed that she did not have any clear idea of the area-based probability and optimization. In addition, she seemed not to know exactly why the shifts of her aim brought more tickets to her and what it meant.

Since reduction of trials resulted in decrease of opportunity for learning, Nancy seemed only to maintain her goal of having fun and it was hard for her to think deeply or develop useful strategies. Even if she was wrong, she had no chance to correct her actions or misconceptions as long as she could not figure out what was wrong even though she could get some feedback from the game. Therefore, she showed less confidence on her response or performance when I asked some questions about her activity. She did not answer to my questions sometimes or she tried to read my face in order to know my expectation or she changed her answers according to my reaction. Comparing these two different cases, group activity and individual activity as shown above, the interaction with others can be construed not only by the process of imitation or modeling, but also by the facilitators and evaluators of their learning and developers of their affirmative identity on what they did by changing their engagement.

On the other hand, my intervention helped the children to reflect on the relations between different activities and renegotiate the leading activity so that their goals in the activities might be changed. Since this change is also close to the transformation in their conception and learning, I describe the shifts with the children's conceptual development during their activities over the observation period in the next section.

## V. Frequency-based activity vs. Area-based activity

In order to examine the changes in the children's conceptions, I showed the children two kinds of activities across settings: frequency-based activity and area-based activity. At the beginning, I showed the children Galton board and squares and circle activity in BGC as shown in the first section. After playing games in CEC which were also related to area and frequency-based probability such as Skee-ball game and Scatterball game similar to Galton board, I returned to BGC in order to see the continuity and transformation of the children's learning across settings. I asked the children to play Random Walk game and create their own games as an 'owner' and play as a 'customer.' Although these activities in different settings were separated by more than a week, the children, even not all of them, could see relations between these experiences.

For frequency-based activity, I showed the children Galton board, Scatterball game, and Random Walk in different settings to see the continuity and transformation of their learning across settings. Scatterball had a very similar structure to the Galton board as figure 9 was shown. If a ball comes out from the top to the bottom, the player has to catch the ball with a U-shaped handle and has to put it into the hole in the middle.



Figure 9. Scatterball

There are important visual differences between the two games. In Scatterball, I cannot see the distribution of accumulated results from each trial. In addition, in this game, once the ball enters between the pins, it goes down in a zig-zag between two rows of pins due to the weight of the ball so that the player can know the range of the location in which the ball will land. Random walk game, as shown in Figure 10, has the same conceptual basis as Galton board. To play the game, the player first flips a coin. If the player gets a head, he or she steps forward to the right. If it is a tail, the player steps forward to the left. The player flips the coin again, standing on the new circle. This process is repeated until the player arrives at one of the black dots on the top. You can easily recognize that this Random Walk is almost the same as Galton board if you see

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this Random Walk game upside down even though frequency distribution at the end cannot be found. Thus, this game would be useful to see whether the children could see relations between these two games and there were continuity and transformation of their learning across settings.

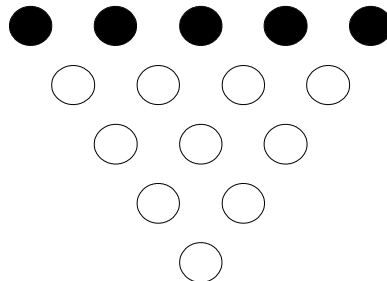


Figure 10. Random Walk

At the beginning in BGC, for the Galton board, I tried to approach this game according to three steps: predicting the result of a single trial; multiple trials; and a single trial again. At the first single trial, the children seemed to try to find some logical reasons rather than believe in the uncertainty of outcome. Some predicted 5 or 7 out of the twelve bins at the bottom because they tracked the path of the ball from the middle of the top along the zigzag line and the ball might not go into bin 6 in the middle because the ball might bounce. G2 predicted that the ball would go straight down and go into the middle and she said, "Most of them don't go the other way." Therefore, they were likely to pay more attention to physical phenomena like the path of the ball and the effects of bouncing.

Although they watched the results of single trials several times, they could not accept the uncertainty of each trial and the patterns of this distribution after I tried a lot of balls. In multiple trials where a lot of balls were dropped at a time, some of them chose two bins that were adjacent to the middle. Two children in one group shared their territories such as 6-10 and 0-5. B2 found that the two highest were adjacent and G1 discovered most of them were in the middle but she also considered how the balls were bouncing.

When I asked questions about the result of a single trial again, they still answered their favorite numbers or the number of a bin which had no balls in it at the end. This showed that the children focused on each specific column rather than the overall pattern of this distribution. In case of B2, even though he knew which column was the highest one after several trials, he thought that no bins remained empty when I tried a single trial again.

Through the Scatterball game, most of the children felt that it was more difficult than Skee-ball. Even though they thought they followed the path of the ball, they easily missed it at the last moment because they had to decide which direction the ball was going to when it passed the last pin. Therefore, the number of tickets they earned from

this game was less than they had expected and it meant that their achievement was lower than their expectations as well. However, through the experience of several trials, they got some sense that most of the balls were dropped into the middle rather than into the sides. They were usually waiting for the ball in the middle. If not, when the ball fell into the sides, they needed to move further from the spot they stayed than from the middle.

In the Random Walk game, I set the children goal as earning money and asked them to bet their money in each black dot in order to see whether they discover the fact that they usually arrived at the dots in the middle. However, the children seemed not to get any sense of what “earning money” meant and what they were supposed to do. Specifically, when I asked them to earn money as many as they could, the girls got confused between the positions of an “owner” and a “customer.” They wanted to make the game more attractive to players. Even though they knew that most of balls might be going into the middle through their previous experiences, they could not understand the relationship between the economic situation and experimental results. I asked them to think about this situation and explain what would happen if they kept their payouts according to the ending points.

Due to my intervention, the girls began to negotiate their conceptual understanding and their goals even though the girls got confused and asked questions about this situation. Since the girls’ goal of designing the game was to make the game attractive to the players, they made the rules on a “customer’s” stance. When the boys played the girl’s game, the girls were surprised by the fact that the boys earned a lot of prizes because the balls usually arrived at the middle instead of the sides. It made the girls want to reconsider their rules in the game they designed. They asked questions a lot about how much should be paid over each outcome. My intervention and their peers’ interaction could be helpful for them to renegotiate their goals and the way to engage in this activity.

Although I shifted the leading activity and the children also engaged in the games, it was not easy for them to design the goals. In the end, the children negotiated their goals from our intervention, not from their needs so that they seemed to have difficulty in designing or establishing their goals by themselves.

At the end, I could find that the area-based model was much easier for the children to access than the frequency-based model. At the beginning, when I asked them to predict where the coin would land on the plane as figure 3 was shown, they had more concerns about external factors like the location of hands which dropped the coin, their favorite colors, good luck and physical movements like bouncing. When I showed the picture of a yellow circle on the blue plane as figure 4 was shown and asked the same question as the previous one, they had no conception of area (Girls: “I prefer yellow so it would land on the yellow circle”) except B2 who answered, “More blue than yellow.” Most of them were not able to connect the probability with the conceptual understanding of area that even if the location of circle was changed, the probability



was not changed and the probability of landing on the yellow was smaller than that of landing on the blue. When I gave the children a chance to reconsider their answers in relation to the payouts for the outcomes like betting money and rewarding according to their choice, some of them changed their answers and gave a thought to fairness but there was not much clearer reasoning.

Through Skee-ball, they negotiated their goals by our intervention and interaction with others and they engaged themselves more in the game but they could not understand it perfectly. However, after these sequences of similar activities and social interaction, most of them seemed to get some sense of area-based probability. They understood that the smaller target was harder to hit exactly than the larger one so that they should have the higher scores for the hardest one.

## VI. Conclusion

The continuity and transformation in learning are developed in the relationship between changing individuals and changing social context. Children's initial goals can be changed across sites and tasks. In the process of conceptual development, the children's interaction with peers and interviewers are important to affect their learning and changes in their goals. The children's cognitions are changed across tasks in their development of goals and learning strategies.

In this study, I found that the children set up subsequent goals for achieving the main goal and they created a new goal toward the main goal as a result from the interactions with others and feedback from the activity. The external goal as an emergent goal from the external factor, such as getting more tickets or more prizes, interrelates with the internal goal as an emergent goal from the tasks or the player. Interestingly, the boys were able to discover the similarity between games and to apply their previous experiences to the next task, whereas the girls seemed not to find the similarity through these sequential activities.

Even though it was hard to see changes in the children's conceptual reasoning in a short time, the children had more opportunity to reconsider their goals and reflect their actions to achieve their goals through our intervention and peer interaction. They were able to learn from these activities. If these processes are repeated, the children might be able to achieve conceptual developments. Through this observation, I was not sure whether all the children improved their conceptual understanding. However, my interventions helped them to renegotiate their goals and leading activity in addition to being a catalyst for them to create new knowledge and new strategies.

In this perspective, teacher's behaviors and interventions in students' learning are crucial in a school setting: how teachers play a role in the children's reasoning and learning, and how the children facilitate their learning through peer interactions. In addition, in this study, one thing that was interesting to me was that someone who had more conceptual understanding in frequency-based activity also had more understanding

in area-based activity. It would be meaningful to investigate the consequential transitions in different kinds of tasks or conceptual systems.

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## 다양한 과제와 맥락에서의 학습 전략과 목표의 연속성과 변환

김래영<sup>2)</sup>

### 초 록

각기 다른 상황에서 각기 다른 활동을 통하여 이루어진 학습의 연속성과 그 변환 과정을 살펴보고, 이 때 일어나는 학습자의 목표와 활동 사이의 관계, 그리고 타인과의 상호작용의 영향을 분석하는 것이 본 연구의 목적이다. 이를 위하여, 5명의 학생들을 각기 다른 상황에서 확률과 관련된 다양한 활동들을 해 보게 하였으며, 집단 면담과 개별 면담, 관찰 등을 통하여 그들의 학습과정 및 사고를 분석하였다. 그 결과, 다양한 상황과 활동 속에서 타인과의 상호작용을 통하여 초기 학습 목표를 수정하여 새로운 목표를 설정하고 다른 활동에서 다시 이를 조정, 발전시키는 반복 과정을 통해 학습의 연속성과 변환이 발생하였으며, 특히, 타인과의 상호작용이 새로운 목표 설정과 전략을 수립하는 데에 결정적 역할을 함을 알 수 있었다. 이는 학습자의 인지 발달 및 수학 학습에 있어 적절한 과제 제시와 교사 역할의 중요성 뿐만 아니라 학교와 학교 외 활동 간의 높은 연속성이 학습을 촉진하고 의미 있게 할 수 있다는 가능성을 제시한다.

주요용어: Emergent goals, Continuity, Transformation, Social interaction

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2) 이화여자대학교 (kimrae@ewha.ac.kr)