

## RESEARCH NOTE

# Cognitive Ethnography: A Methodology for Measure and Analysis of Learning for Game Studies

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## ABSTRACT

*This paper describes cognitive ethnography as a method of choice for game studies, multimedia learning, professional development, leisure studies, and activities where context is important. Cognitive ethnography is efficacious for these activities, as it assumes that human cognition adapts to its natural surroundings (Hutchins, 1995, 2010) with emphasis on analysis of activities as they happen in context; how they are represented; and how they are distributed and experienced in space. The methodology is described for increasing construct validity (Cook & Campbell, 1979; Campbell & Stanley, 1966) and the creation of a nomological network (Cronbach & Meehl, 1955). This description of the methodology is contextualized with a study examining the literate practices of reluctant middle school readers playing video games (Dubbels, 2008). The study utilizes variables from empirical laboratory research on discourse processing (Zwann, Langston, & Graesser, 1996) to analyze the narrative discourse of a video game as a socio-cognitive practice (Gee, 2007; Gee, Hull, & Lankshear, 1996).*

*Keywords:* Cognitive Ethnography, Comprehension, Design, Discourse Processing, Game Studies, Literacy, Reading, Socio-Cognitive, Validity

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## INTRODUCTION

As a methodological approach, cognitive ethnography assumes that cognition is distributed through rules, roles, language, relationships and coordinated activities, and can be embodied in artifacts and objects (Dubbels, 2008). For this reason, cognitive ethnography is an effective way to study activity systems like games, models, and simulations—whether mediated digitally or not.

## BACKGROUND

In its traditional form, ethnography often involves the researcher living in the community of study, learning the language, doing what members of the community do—learning to see the world as it is seen by the natives in their cultural context (Fetterman, 1998).

Cognitive ethnography follows the same protocol, but its purpose is to understand cognitive process and context—examining them together, thus, eliminating the false dichotomy between psychology and anthropology.

Observational techniques such as ethnography and cognitive ethnography attempt to describe and look at relations and interaction

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situated in the spaces where they are native. There are a number of advantages to both laboratory observation and in the wild as presented in Figure 1.

## NOMOLOGICAL NETWORK

As mentioned, Cognitive Ethnography can be used as an attempt to provide evidence of construct validity. This approach, developed by Cronbach and Meehl (1955), posits that a researcher should provide a theoretical framework for what is being measured, an empirical framework for how it is to be measured, and specification of the linkage between these two frameworks. The idea is to link the conceptual/theoretical with the observable and examine the extent to which a construct, such as comprehension, behaves as it was expected to within a set of related constructs. One should attempt to demonstrate convergent validity by showing that measures that are theoretically supposed to be highly interrelated are, in practice, highly interrelated, and, that measures that shouldn't be related to each other in fact are not.

This approach, the Nomological network, is intended to increase construct validity, and external validity, as will be used in the example, the generalization from one study context, such as the laboratory, to another context, i.e., people, places, times.

When we claim construct validity, we are essentially claiming that our observed pattern

-- how things operate in reality -- corresponds with our theoretical pattern -- how we think the world works. To do this, it is important to move outside of laboratory settings to observe the complex ways in which individuals and groups adapt to naturally occurring, culturally constituted activities. By extending theory building with different approaches to research questions, and move from contexts observed in the wild, then refined in the laboratory, and then used as a lens in field observation.

The pattern fits deductive/ inductive framework:

- Deductive: theory, hypothesis, observation, and confirmation.
- Inductive: observation, pattern, tentative hypothesis.

These two approaches to research have a different purpose and approach. Most social research involves both inductive and deductive reasoning processes at some time in the project. It may be more reasonable to look at deductive/inductive approaches as a mixed, circular approach.

Since cognition can be seen as embodied in cultural artifacts and behavior, cognitive ethnography is an apt methodology for the study of learning with games, in virtual worlds, and the study of activity systems, whether they are mediated digitally or not. By using the deductive/ inductive approach, and expanding observation,

Figure 1. Features of methodology

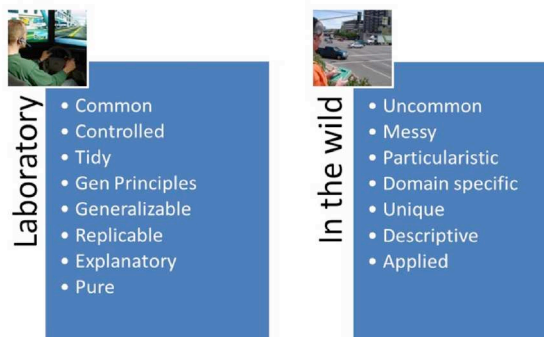
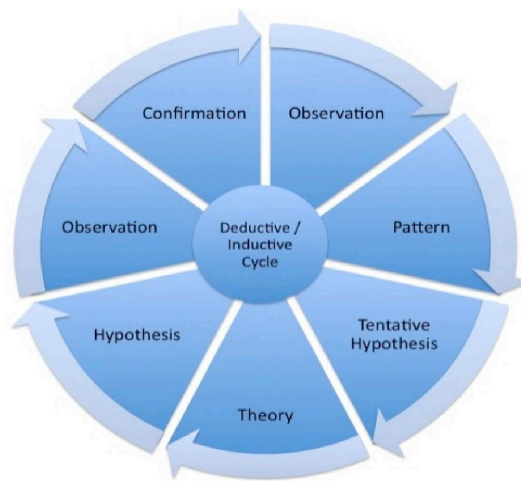


Figure 2. Inductive/deductive cycle



one can contrast and challenge theoretical arguments by testing in expanded context.

Cognitive ethnography emphasizes inductive field observation, but also uses theory in a deductive process to analyze behavior. This approach is useful to increase external validity, operationalize terms, and develop content validity through expanding a study across new designs, across different time frames, in different programs, from different observational contexts, and with different groups (Cook & Campbell, 1979; Campbell & Stanley, 1966).

More specifically, cognitive ethnography emphasizes observation and key feature analysis of space, objects, concepts, actions, tools, rules, roles, and language. Study of these features can help the researcher determine the organization, transfer, and representation of information (Hutchins, 1995, 2010).

### Ontology/Purpose of Cognitive Ethnography Methodology

As stated, cognitive ethnography assumes that human cognition adapts to its natural surroundings. Therefore, the role of cognitive ethnographer is to transform observational data and interpretation into meaningful representa-

tions so that cognitive properties of the system become visible (Hutchins, 1995, 2010).

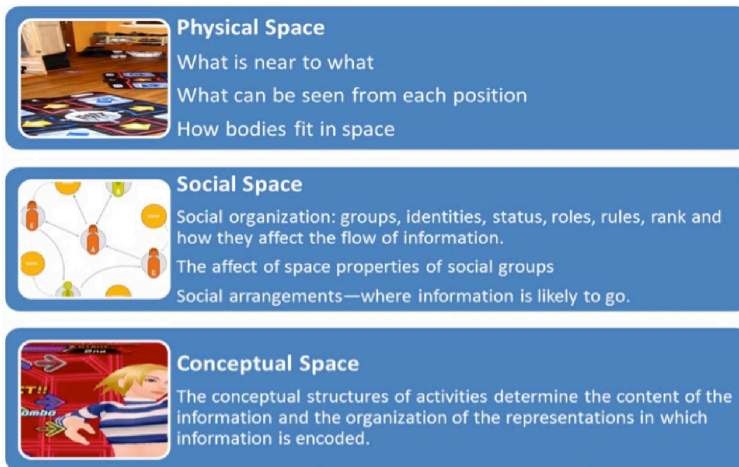
According to Hutchins (2010) study of the space where an activity takes place is a primary feature of observation in cognitive ethnography. He lists three kinds of important spaces for consideration (Figure 3).

## APPLICABILITY

Cognitive ethnography is an apt methodology for the study of games, simulations, narrative, and human interaction in authentic context. In the following example, the game play of adolescents was observed to identify whether the play of a video game may represent a literate practice with possibility of accelerating ability with print text narratives typical of classroom work. In the analysis, video games were treated as printed text, although mediated through computer interaction. Just as a book is organized to present information, games also structure narratives, and are themselves cultural artifacts containing representation of tools, rules, language, and context (Dubbels, 2008).

Because video game play often occurs in the three spaces identified in Figure 3., it is

Figure 3. Important spaces for analysis of activity from Hutchins (2010)



reasonable to use the methodology, and also use the framework of literacy. Space is indicative of current approaches to literacy (Leander, 2002; Leander & Sheehy, 2004); as well as critical science and the studied interaction between the internal world of the self and the structures found in the world, and how we communicate about them (Soja, 1996; Lefebvre, 1994); also from the tradition of ecological views on cognitive psychological perspectives (Gibson, 1986),; and in the case of the example, Discourse Processing (Zwaan, Langston, & Graesser, 1996). Because of the emphasis in ontology and purpose of the method align so closely with the variables identified in the Discourse Processing model (Zwann, Langston, & Graesser, 1996), it was applicable as a methodological approach to create a convergence of theory and tradition predicated upon an approach that aligns in purpose with analysis and question.

## EXAMPLE

As an example, Dubbels (2008) used cognitive ethnography to observe video game play at an afterschool video game club. The purpose of this observation was to explore video game play as a literate practice in an authentic context. The cognitive ethnography methodology was

recruited to utilize peer reviewed empirical research from laboratory studies—utilizing narrative discourse processing to interpret the key variables—to extend construct validity and observe whether the laboratory outcomes appeared in authentic, native contexts.

This allowed the researcher to interpret observations of authentic video game play in an authentic space through the lens of empirical laboratory work at an afterschool video game club.

## Guiding Question

The focus on space and social context, and the methodology for this example of cognitive ethnography explored a statement from O'Brien and Dubbels (2004, p. 2),

*Reading is more unlike the reading students are doing outside of school than at any point in the recent history of secondary schools, and high stakes, print-based assessments are tapping skills and strategies that are increasingly unlike those that adolescents use from day to day.*

These day-to-day skills and strategies were viewed as literate practice and theoretically.

They led to the guiding question:

- Can games be described as a literate practice as has been described by theoreticians?

If so, this should be apparent through:

- Observing game play.
- Understanding the game narrative and controls,
- And doing analysis of interaction and behavior. Should the words behind the bullets be capitalized since you have it in sentence form?

## Hypothesis

The guiding question: whether games could be viewed as a literate practice, was extended to create a hypothesis to test:

- Can the literate practice of gaming be used to facilitate greater success with printed text?

The hypothesis would be tested through examination of game play narratives and printed text narratives—as described in the Nomological network section; this would be an deductive/inductive process. The use of the variables from the Event Indexing Model could be used for identifying levels of discourse and the ability to create a mental representation after the inductive observation process.

The hypothesis was predicated upon the theory that familiarity with patterns in text, from symbolic representations such as words, sentences, images, and story grammars. The story grammar being “once upon a time,” in a game might be used as a developmental analog to help struggling readers predict the structure and purpose of print narratives by helping them to expect certain events, characters, and settings and help the reader to become more efficient. In essence, they would have expectations that “once upon a time” leads to “happily ever after”, and other genre patterns attributable to transmedial narrative genre patterns.

The theory is that a reader may be capable of compensation, i.e., the use genre patterns and

predictive inference as higher-level process in order to support lower-level process (Stanovich, 2000). It was proposed that to develop meaningful comprehension, the propositional and situation levels might be built upon for building mental representation of printed narrative text with the game.

## Context and Variables for Coding and Analysis

Literate activities were codified based upon a well-established model of discourse processing, The Event Indexing Model (Zwann, Langston, & Graesser, 1996). The Event Indexing Model offered five levels of discourse processing: Surface Level, Propositional Level, Situation Level, Genre Level, and Author Communication.

These levels offer an opportunity to view comprehension as a transmedial trait across discourse.

The Situation Level (Figure 4) is composed of two sub-levels of the variable. These are aspects of mental representation called the Dimensions of Mental Representation and are composed of: time, space, characters, causation, and goals (Figure 5).

These variables of the discourse-processing model were used to code the transcripts from the game club audio/video games, and context in order to explore the familiarity the students had with patterns in discourse, and their ability to recognize and process them.

In order to observe the literate activities of students in their chosen medium, we offered the after school game club to students who had been selected by school district professionals for reading remediation courses outside of the mainstream. The video game play and activity space was analyzed from direct observation and analysis of audio/video recordings and photos taken during the activity.

## Conceptual Space Analysis

Walkthroughs of the game were used to look at decision making through navigation of the game. A Walkthrough, according to Dubbels (2009), is a document that describes how to

Figure 4. Levels of discourse comprehension from the event indexing model

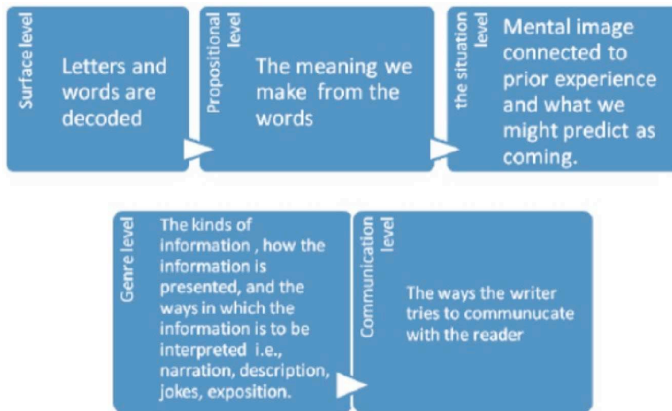
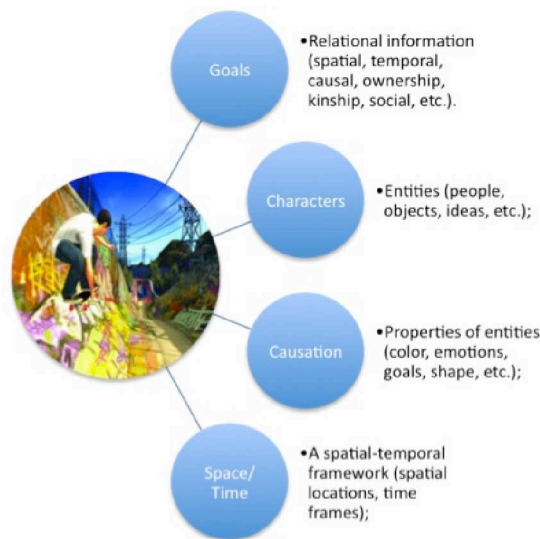


Figure 5. Dimensions of a situation in the event indexing model



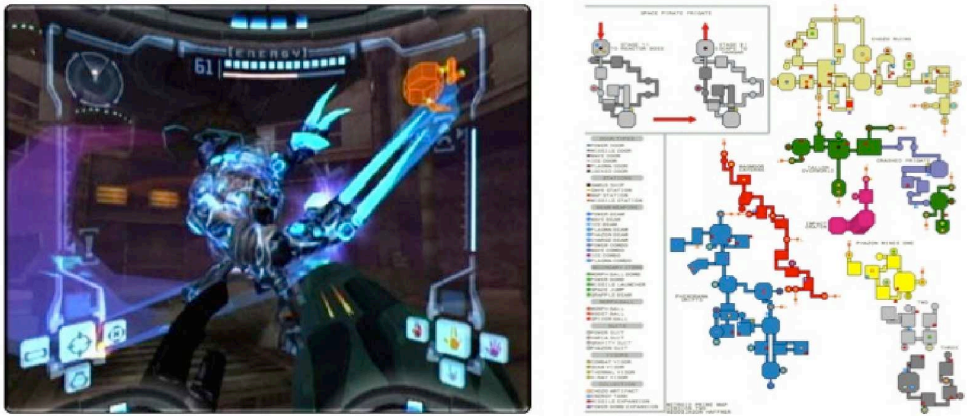
proceed through a level or particular game challenge. Walkthroughs are created by the game developer or players and often include video, audio, text, and static images—offering strategies, maps through levels, the locations of objects, and important and subtle elements of the game.

In order to have a thorough understanding of possible the goals, actions, and behaviors

available in the game, a number of walkthroughs were analyzed along with the game controls, and maps for optimal play (Figure 6).

### Physical Space Analysis

To create the cognitive ethnography of the video game play, two video captures were used: one to record the screen activity and one to record player interaction with the game and play space.

Figure 6. *Metroid Prime Echoes* interface and map of game space

Because the player of the game was often highly engaged with problem solving and reacting to the game environment, there was often little-to-no dialog or variation in expression and body language; however, play was often done in the company of others. This was informative as the discussion, encouragement, and advice displayed the social and cultural knowledge of the strategies of game play. In addition, a still camera was made available for the students to take pictures for their club. This included digital pictures of the games screens and each other playing, or whatever they felt was interesting.

### Social Space Analysis

The audio and video and still images were used for analysis of the social space, as well as the physical space. However, another level of data collection involved showing the player the video recording of their play and action in the room were used for a “reflect aloud” (Ericsson & Simon, 1983) for them to describe their play and social interaction. The key feature was not only observing the play, but also identifying theories of relationships, cognition and social learning—“what were you thinking there?” was the main question asked. This dialogue served to explain the player’s reasoning and decisions without overt interpretation by the observer. This enhanced the description, and connected

the naturalistic game play to the laboratory, and then back to behavior in the wild.

It was this exploration of theory that led to the study of struggling readers using video games as methods for observing levels of mental representation and recall in game play and reading. Using the Cognition Ethnographic approach allowed for comparison of students observed playing video games with friends, the dialog and behaviors that constituted game play as a literacy (Gee, 2007; Gee, Hull, & Lankshear, 1996.) and their formal academic reading behaviors. Because the boys were observed in a formal laboratory setting, it was possible to make comparisons of their game play in the informal, or wild, autonomy supporting space.

### Examples of Analysis

An example of the game play observation comes from Dubbels (2008, p. 265):

*Since Darius seemed to know what he was talking about, he went next, and as he played, the other boys watched and were excited with what Darius was able to do. Darius seemed happy to demonstrate what he knew. While I was recording, the boys described Darius’ play and shared ideas enthusiastically about how the game worked and looked forward to their chance to play. As Darius made a move where*

*he showed how to do a double bomb jump, the boys watched intently. The way it was explained was that you lay a bomb, and right before that bomb explodes, set a second one, then set a third just before you reach the very top of the jump. You should fall and land said the easiest way “is to count out: 1, 2, 3, 4.”*

*And he laid the bombs on 1, 3, and 4. The boys were excited about this, as well as Darius’ willingness to show them. What was clear was that Darius had not only had played the game before, and as I questioned him more later I found that he had read about it and applied what he had read. He had performed a knowledge act demonstrating comprehension.*

*The other boys were eager to try some of the things Darius had shown them, and Darius was happy to relinquish the controller. What happened from there was that Darius watched for a while and then walked over to the Xbox, and then to the bank of computers. I left the camera to record the boys playing Metroid Prime and I walked over to see what Darius was doing. He showed me a site on the Internet where he was reading about the game. He had gone to a fan site where another gamer had written a record of what each section of the game was like, what the challenges were, cool things to do, and cool things to find. I asked him if this was cheating; he said “maybe” and smiled. He said that it made the game more fun and that he could find more “cool stuff” and it helps him to understand how to win easier and what to look for:*

*This idea of secondary sources to better understand the game makes a lot of sense to me. It is a powerful strategy that informs comprehension as described previously in this chapter. The more prior knowledge a person has before reading or playing, the more likely they are to comprehend it fully. Secondary sources can help the player by supporting them in preconceiving the dimensions of Level 3 in the comprehension model,*

*and with that knowledge, the player may have an understanding of what to expect, what to do, and where to focus attention for better success. Darius has clearly displayed evidence that he knows what it takes to be a competent comprehender. He had clearly done the work in looking for secondary sources and was motivated to read with a specific purpose—to know what games he wants to try and to be good at those games. His use of secondary sources showed that he was able to draw information from a variety of sources, synthesize them, and apply his conclusion with practice to see if it works.*

One of the key features of the cognitive ethnography is the realization that even the smallest of human activities are loaded with interesting cognitive phenomena. In order to do this correctly, one should choose an activity setting for observation, establish rapport, and record what is happening to stop the action for closer scrutiny. This can be done with photos, video, audio recording, and notebook. The key feature is event segmentation, structure in the events, and then interpretation.

As was presented in the passage from Dubbels (2008), analysis was done describing the social network surrounding the game play of one boy describing the different spaces, and the behaviors of the boys surrounding him. The link to game play and strategy for successfully navigating the video game can be considered an analog to how young people read print text when a model is used as a framework for analysis.

One can then connect the cultural organization with the observed processes of meaning making. This allows patterns and coherence in the data to become visible through identification of logical relations and cultural schemata. This allowed for description of engaged learning when the video students approached the game, their social relations, and how they managed the information related to success in the game, reading the directions, taking direction from others, secondary sources, and development of comprehension during discourse processing compared to the laboratory setting.



In order to see if there was transfer, students were asked to work with the investigator in a one-on-one read aloud in a laboratory setting. The student was asked to read a short novel, *Seed People*, to the investigator for parallels and congruency between interaction of narratives found in game play, and traditional print-based narratives found in the classroom.

*What I noticed in talking to them about Seed People was that they would read without stopping. They would just roll right through the narrative until I would ask them to stop and tell me about what they thought was going on, with no thought of looking at the situations and events that framed each major scene, and then connecting these scenes as a coherent whole as is described earlier in the chapter as an act of effective comprehension.*

*In one case Stephen made interesting connections between what he saw with an older boy in the story and the struggles his brother was having in real life. I just wondered if he would have made that connection if I had not stopped at the close of that event to talk about it and make connections. This ability to chunk events and make connections, as situations change and the mental representation are updated, is important for transition points in the incremental building of a comprehensive model of a story or experience.*

*When working to teach reading with this information, it is important to connect to prior knowledge and build and compare the new information to prior situation models or prior experience. Consider a storyboard or a comic strip where each scene is defined and then the next event is framed. Readers need to learn to create these frames when comprehending text. Each event in a text should then be integrated and developed as an evolution of ideas presented as each scene builds with new information; the model is updated and expanded.*

*If the event that is currently being processed overlaps with the events in working memory on a particular dimension, then a link between those events is established, then a link between those events is stored in long-term memory. Overlap is determined based on two events sharing an index (i.e., a time, place, protagonist, cause, or goal) (Goldman, Graesser, & van den Broek, 1999, p. 94)*

In this instance with Stephen, there were many opportunities for analysis with the spaces described by Hutchins. The boy made connections to family outside of the novel, to his brother, to make it meaningful and also chunk a large section of the book as an event he could relate to. There was also the description of the setting, where Stephen was not pausing or processing the narrative in his reading. The activity did not include any social learning or modeling from friends and contemporaries, but resonated the controlled formal environment of school.

Thus, it was concluded that we must build our understanding in multiple spaces. The attributes of the situation model were made much more robust and much more easily accessible when prior knowledge was recruited and connected with the familiar.

Two types of prior knowledge support this in the Event Indexing Model:

- **General world knowledge** (pan-situational knowledge about concept types, e.g., scripts, schemas, categories, etc.), and
- **Referent specific knowledge** (pan-situational knowledge about specific entities).

These two categories represent experience in the world and literary elements used in defining genre and style as described from the Event Indexing Model. The theory posits that if a reader has more experience with the world that can be tapped into, and also knowledge and experience about the structure of stories, he or she is more likely to have a deeper understanding of the passage.

In the case of the game players, it was seen to be important for seeking secondary sources, as well as copying the modeled behavior of successful players like Darius and segmenting action into manageable events.

This was also evident when the students were asked to read aloud print text from the *Seed People* novel. The students, like Stephen, showed they had difficulty segmenting events, or situations, just like they had difficulty with game play.

Of the fourteen regular students in the club, only two were successful with the games. After further interview and analysis, the two successful gamers were able to translate their knowledge of game narratives into success with printed text. They were found to be lacking in confidence, not reading ability. Conversely, the twelve students who struggled had to learn the help seeking strategies and narrative awareness. This was done through further practice with video game narrative training and further practice with chunking and segmentation of units of meaning with printed text.

## CONCLUSION

For this study, cognitive ethnography was an appropriate methodology as it allowed for observation and analysis of the social and cultural context to inform the cognitive approach taken by the game players. It improved external validity from the laboratory study by applying the same construct to a new time, place, group, and methodology.

The cognitive ethnography methodology presents an opportunity to move between inductive and deductive inquiry and observation to build a Nomological network. The cognitive ethnography methodology can provide opportunity to extend laboratory findings into authentic, autonomy supporting contexts, and opportunities to understand the social and cultural behaviors that surround the activities--thus increasing generalizability. This opportunity to use hypothesis testing in an authentic setting can provide a more suitable methodology for

usability and translation for other contexts like the classroom, professional development, product design, and leisure studies.

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