CHAPTER 22.

IMMERSED IN THE GAME OF SCIENCE: BELIEFS, EMOTIONS, AND STRATEGIES OF NNES SCIENTISTS WHO REGULARLY PUBLISH IN ENGLISH

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Not all scientists or researchers need to communicate their research in English. However, those who do face a complexity of challenges as we discussed in an earlier publication where we examined the struggles of non-native English Speakers (NNES) to become engaged in international scientific fields conducted in English (Bazerman, Keranen, & Encinas, in press). There we argue that lack of experience and fluency in English impede their immersion in cutting edge science, but lack of immersion in cutting-edge science limits their experience in scientific English, impeding growth of fluency to support more complete, immersive participation. Thus, scientific success breeds linguistic success and linguistic success supports scientific success, in a version of the "Matthew Effect" by which the rich get richer and the poor get marginalized (Merton, 1968).

Applied linguistics studies of the experience of NNES scientists writing in English for international publication have focused on novice scientists at the periphery of their fields who have not yet achieved success or fluency (reviewed in Bazerman, Keranen, & Encinas, in press). However, there is very little available research on NNES scientists who have managed, in spite of the well-documented problems, to succeed.

In this current chapter, we explore more fully what it means for an NNES scientist to overcome linguistic and scientific challenges to become a successful published researcher in an English-dominant discipline. In particular, we study the psychological orientation that a group of successful NNES physicists and mathematicians working in Mexico have developed in the course of their careers. We find that they are deeply immersed and invested in the work of sci-

DOI: https://doi.org/10.37514/PER-B.2012.0452.2.22

ence. They strongly identify with their scientific careers, played out within an international community to which they contribute by their publications.

We find that their self-reported confidence in their expertise is matched by a set of dispositions and orientations similar to those of immersed players of computer games. Karl Popper (1959) conceived of science a game—an activity, like games, subject to a set of rules structuring a competition between theories. Zamora-Bonilla (2010) further proposed that the "competition" is between the *scientists* rather than their theories. Our interview study indicates that this game metaphor can tell us much about how successful NNES scientists orient towards and participate in writing for their international community.

STUDY PARTICIPANTS

The participants were NNES scientists working in a faculty of physics and mathematics in a large public research university located in central Mexico. We used purposive sampling to select the experts with the highest levels of institutional recognition of expertise, i.e., those recognized by membership and rating (with rating 3 the highest) within the *Sociedad Naciónal de Investigadores (*SNI) (the National Society of Researchers). SNI membership and rating are based on triennial evaluations of academic production, including funded research projects and publication in international high impact journals. Their professional profiles generally conform to international definitions of successful scientists working in academic settings (Keranen, 2008).

The participants represented a number of specialties, came from a variety of national and linguistic backgrounds, and ranged from mid-career to late career as indicated in Table 1.

METHODS

We used three methods to interview these subjects. First, we used narrative life story interviews to understand the dispositions and orientations that lie behind the expert performances and to understand how they currently defined themselves in terms of professional development and to bring out antecedent factors which might have contributed to their levels of development (Lieblich, Tuval-Mashiach, & Zilber, 1998). To elicit the data, we provided each interviewee with a sheet of paper listing numbers to indicate the years of their life, but otherwise blank. They were then asked to either fill in information related to anything that seemed important to them or just to use the format to ori-

ent their narrative to the years. The scientists talked about the periods of their lives, important people, their personalities and reactions to events. We asked follow-up questions when necessary to prompt details and to encourage them to think about their lives and experiences as those events related to their career development.

The second interview protocol, based on Gordon and Dawes (2005), elicited the subjects' experiences associated with their ability to write publishable scientific articles in English. This protocol used a framework or "array" for arranging the interview data (see Figure 1).

The elements elicited in the interview were from four principal categories: beliefs—a central belief criterion, cause and effect—and equivalencies beliefs; emotions—sustaining (i.e., those held all the time regarding the activity) and feedback emotions (those that give information about the activity when engaged in it); strategies—primary and secondary (used when primary strategies fail); and external behaviors—any other behaviors when engaged in the activity.

During the interview the interviewer acted as a mediator or guide to help the participant access his (all the participants were males) subjective experience through guided questioning (cf. Varela & Shear, 1999). The process adopts a second-person subjective perspective rather than a third-person objective view (as, for example, in a standardized questionnaire) or a first-person subjective account (as in the open-ended reflective narrative). The array (see Figure 1) is filled out by the interviewer in the course of the interview, but open to visual inspection by the interviewee, so that it can serve as an explicit framework for conducting the interview, allowing the interviewer and interviewee spontaneously and associatively to co-construct the recorded responses and make sure all items are covered. While this protocol does not purport to provide a complete representation of the individual engaged in the activity, it does elicit and map a number of elements of the interviewee's orientations to the activity and competence explored. Further, while the array factors are separated for the purposes of elicitation and analysis, they are likely enacted in practice as an integrated ensemble within the ability.

Finally, to clarify certain issues found in the narrative and array data, semi-structured interviews (eight open-ended items) were sent to the participants via email, with one further face to face follow-up interview. Trustworthiness of the data was established based on member checking of the interview data at the close of the interviews (Creswell, 2003).

Ten of the narrative and array interviews were carried out in Spanish; the rest, in English. These interviews were then transcribed, and the Spanish ones translated into English. The follow-up semi-structured interviews were in English or Spanish depending on the primary language used in the other interviews.

Table 1. Study participants' research areas, career levels, SNI levels and nationalities

ID	Research Area	Career level	SNI Level	Nationality
R14	Particles, fields and general relativity	Mid-career	3	Mexican
R9	Particles, fields and general relativity	Mid-career	1	Mexican
R6	Particles, fields and general relativity	Mid-career	2	Mexican
R3	Particles, fields and general relativity	Late-career	Unknown	Mexican
R7	Optics	Mid-career	1	Mexican
R12	Optics	Late-career	2	Mexican
R11	Mathematical analysis	Late-career	2	Cuban
R15	Mathematical analysis	Mid-career	2	Mexican
R10	Differential equations and mathematical modeling	Late-career	2	Cuban
R13	Differential equations and mathematical modeling	Late-career	2	Russian
R5	Quantum optics	Mid-career	1	Salvadoran
R1	Quantum optics	Mid-career	1	Mexican
R2	Optoelectronics and photonics	Mid-career	1	Mexican

Each participant's interview data were entered in Atlas.ti (ver. 5.7.1) as primary documents. The narrative and elicitation data were then coded and analyzed independently by two of the study researchers. The two analyses were then brought together and discussed and further refined by all three researchers.

RESULTS

Self-Reported Characteristics of Expert Status

In the narrative interviews all our successful NNES scientists define their expert status as writers of publishable scientific papers in English based on international recognition, a strong network of connections with other researchers on international and national levels; international publication; and citations. Several also mentioned their role in forming researchers and directing master's and doctoral theses; two also mentioned the importance of engaging in more popular forms of science dissemination. They all feel pride and accomplishment in their work that they perceive as important to themselves, their institutions, and the wider world (Keranen, 2008).

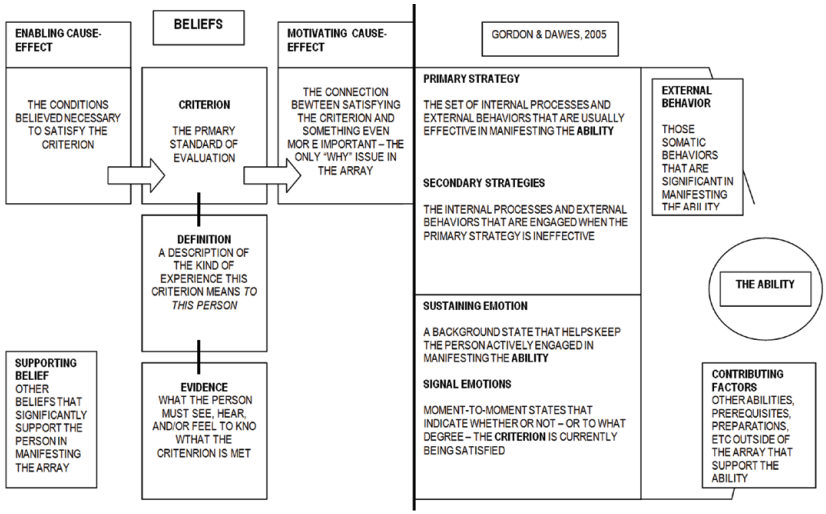

Figure 1. Blank Array (taken from Gordon & Dawes, 2005, pp. 192-193)

Reports of Subjective Orientations

The second interview protocol incorporated elicited subjective reports of the beliefs, emotions, and strategies associated with producing publishable articles in English. We present the results in each area in separate sections.

Beliefs

For Gordon and Dawes (2005) the center of the beliefs is the criterion. For all of the participants the criterion of success was whether they contributed new results to the international scientific community, which they also believed conformed to the expectations of that international community. R5 comments:

> Well, I think we always want to present, to highlight the physics results that we have on hand. So that's always the main, the main thing that I try to keep in mind when I write. … So this is something that we always have in mind, to put in perspective the physics results, eh to write some paragraphs saying "previous to this work, people did this and that, now I'm going to describe my eh, recent results" and mm, always in a thesis very important for physics you have to publish this because if you don't do that the world stops

> revolving! (R5—original English).

The evidence indicating whether their criterion is being met is based on a model they have of how scientific articles should be written. To construct this model (enabling cause and effect beliefs), they all emphasized the importance of extensive reading in their fields, and some (R1, R2, R6, R12) mentioned the importance of reading literature and other types of genres in English to acquire a kind of ear for the language and of the target discourse. Six mentioned the importance of speaking in English. They noted a connection between their spoken and written English, as R6 explains.

> I would like to say something which comes from my experience. If I speak better, I write better. I found that eh, that procedure, at the beginning my speaking expression was not good, so my writing was not good. So I found it's good to practice English conversation, speaking English conversation, then writing is easier. I don't know how, I don't know, I'm sure you have found this relation, if you speak well, you write well (R6—original English).

Immersion into the profession and their work was also reported within their cause and effect beliefs, both as an enabler and as a motivator. For these scientists the motivation is to be able to participate in the wider international community. "Puedo decir cosas" [I can say things] (R9). One of the most dominant motivating factors is whether they can write in English at a level that conforms to the community's expectations—reporting research that is valued by the community, they will be cited, one benchmark in their development, one piece of evidence that says they have arrived.

> I don't publish only for the SNI. I want to establish relationships with other members of the physics community. … When you publish in the sciences you feel proud when other people quote your work. This is probably the most important step. Now after 10 years, I received 12 references for a more theoretical article I wrote in 1998 … The truth is it is very exciting (R5—original English).

Several researchers express being motivated by their being able to participate in and contribute to the professional community and the pride from doing so.

Emotions

Most of the scientists like to write in L1 and L2. They feel challenged and rewarded, both internally and externally for their efforts, so they continue to do it in spite of the negative emotions sometimes encountered:

> Ah, well always is a challenge to write. It's always a challenge to write something and I eh, I have to, like yesterday I was finishing a report from last year, and I knew that I have to write at the end, I have to write an acknowledgment to the eh, financial organization who gave us the support to do this and I was trying to say "Thank you" in a very formal way and I was very stressed, trying to say, well, not saying thank you very much, it was crucial, not but trying to be, to have an official document saying that the help was good but not only they helped us, only my Mexican agencies helped us so. My problem was to give the correct portion of credits to everybody. That was the difficult part (R6—original English).

Their feedback emotions range from pride, happiness and satisfaction, to frustration, anxiety and "torture," as R5 expresses when referring to his secondary strategies engaged when experiencing a type of "writer's block."

Strategies

Many of their writing strategies are specific to the individual, but in general they all use writing models. They are aware of genre conventions in their fields and use published articles as templates for their writing. They perceive the value of extensive knowledge and experience in writing new research:

> Because yes it is easier, because one has a more experience, it is easier to choose a good research topic and choose especially when I am going to choose something. The first thing one thinks, is in what journal am I going to publish this before I see if I'm going to do it or not (R11—translated from Spanish).

They have certain established ways of going about the writing as well. Almost all of them say they write the introduction sections and the abstract last because

the most important elements are the results and the conclusions of the work, the elements that are going to be evaluated by the international scientific community (R1, R2, R5, R6, R9, R11, R14). Most stated that they find the introductions much more difficult to write than other sections. None write a paper alone. They all rely on a variety of help from colleagues, some L1 English speakers and some L2 English colleagues who have a greater command of the language:

> First I did everything like intuitively, and a few years ago I met a colleague from Colima, his English is much better that mine. I compare many songs of Pink Floyd. I don't understand the lyrics and then he explains them to me. So what he does is that from the very beginning that we start a project he starts to write notes in English, and then making that a paper is easier and that's something that I'm starting to do. I would write but many small pieces, very disorganized and now I'm trying from the very beginning to write and it's easier to make a paper from that. There are also some things, some information from previous papers that one repeats. It's not very creative but, then the papers look flat and I like the papers from this friend of mine. They are better. I would like to improve that (R14—original English).

Planning before writing is also something that comes up.

> I, before, when I learnt eh, some years ago, was to, not to start writing or to sit in front of the computer. I, I like to think what I want to express what I want to communicate and, in my mind I just to, to construct the paper and then I sit and I start writing. Sometimes I found that I get stuck in my mind I cannot follow, I cannot follow the idea I cannot develop the idea, then I start writing eh, staying there for minutes, hours and then I start writing my documents (R5—original English).

The language used to write initial drafts also varies. Many will start in Spanish and then work with co-authors, graduate students, and even family members to change the language to English (R2, R3, R7, R13, R15). Some use a combination of languages:

> A champurrado as we say in Mexico, that is, some parts in

> English and others in Spanish and the last because it is more or less uniform. Because sometimes you write ideas and concepts that are already previously made of course, then one has to be more or less consistent with oneself, one then grabs pieces of other authors or one who has written in English, and then one pulls them. The copy, it reformulates them. This writes it in English and others are original ideas which are written, that is the rule, if they are written then already are not original, this one writes and translates them. But it is a question I already learned in English; my son is also a researcher. He is in chemical engineering and originally writes articles in English directly. He had the chance to take English from a very young age and I did not (R12—translated from Spanish).

R1, R5, R6, R14 write in English only.

In terms of more external actions when writing, seven explicitly mention the need to eliminate all distractions and to remove themselves from the physical world (R1, R5, R6, R9, R14, R11, R15):

> You are forgetting about your family, about students, about paperwork, about everything. And you want to report the results in these graphs, in only these two graphs … I'm here in the office I lock the door, close the curtains. … Not showing the face of the enemies, not talking to anyone in the university, showing that you are not for no one, exchange no word, not saying hello to anyone, not drinking water so you don't have to go to the bathroom. I'm even disconnecting the internet connection because it is time to be down in the hole, to take yourself in your hands, I need to focus … I need to focus myself … the best way for me to write is when I'm at home alone there is no one there. I'm just there with my coffee … I'm there just for writing, nothing more (R5—original English).

When their primary strategies fail, all of the scientists report secondary strategies that they mobilize to help them write. These involved things like starting over again, using organizers—adhesive notes which could be moved around and rearranged, going back to articles and reading for ideas, and when all else fails all said they remove themselves physically from the task and come back

later. What might differentiate these experts from novices, as substantiated in the expertise literature, is their ability to know what secondary strategies they can set in motion to keep writing and to have enough self-awareness to know when they need to physically remove themselves from the writing situation and come back to it later.

Understanding Immersive Engagement

The researchers in this study have all managed to participate in international science at a high level by publishing results that meet the current research interests and standards of their fields. In doing so they have developed psychological orientations toward their work revealed in their beliefs, emotions, and strategies that show themselves immersed in the world and work of their specialties. In this sense we can see their writing as enabled by a set of dispositions towards their perceived situation (Russell & Harms, 2010, drawing on Bereiter, 1995).

Their criteria for success internalize the criteria of their fields, and the evidence of their success is in produced work that meets these standards and becomes published and recognized as contributing to their fields. They find the work enabled by increasing their own engagement and participation by reading, immersing oneself in the language and culture, taking writing courses, writing drafts, and increasing social connections. They are motivated by their participation in the field, and their increasing levels of access, participation, and opportunities as their recognition in the field advances. They enjoy the work and challenge, although they find it exhausting and at times frustrating.

The engagement these authors have shown with scientific writing bears strong psychological similarities to the kind of engagement found among players of computer games, particularly Massively Multiplayer Online Role-playing Games (MMORPGs). Four elements of similarity stand out: 1) the "virtual worlds" with their 2) characteristics of worldwide collaboration, participation, and advancement, enhanced and motivated by 3) occurrences of "flow" from immersive states and involving 4) complex cognitive functions necessary for these levels of participation. For each of these interconnected features we bring in corresponding evidence from the gaming literature and link it to evidence from our data.

Virtual Worlds

A "virtual world" in the MMORPG is a simulated environment or community, society or culture accessed by members, characters, or players through remotely located computers. Typically, players engage in activities that lead to

forms of progression—from novices to those of higher status based on experience in the game. This comes about through their social interactions and actions in the community. Immersion into the game is seen as critical to success and enjoyment and motivation to stay in the game (Jennett, Cox, & Cairns, 2009). Such immersion involves "perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" (Witmer & Singer, 1998, p. 227).

The similarities with the scientific worlds of our researchers are clear. Their research, articles, and presentations are their vehicles for participation. When asked what percentage of the time the researchers were thinking of their work—in their virtual worlds—most replied around 70-80%. R15 stated:

> I have a feeling that all the time I am thinking what I'm doing and what should I do. However, in reality it can't be so. If I feel that I spend in the university an average nine or 10 hours a day, counting that also I take my backpack home to continue writing or resolving a problem, then they are like 10 or 12 hours a day. I think that in these last five or four years I've obsessed with work, more than in previous years. Work is thought and when not specifically working anyway there is thought about work. In addition, at night, I sleep thinking about some problem. I sleep but soon after I wake up and am still thinking about the problem. I believe that I have had some success with this method (R15—translated from Spanish).

When reflecting on his processes of becoming a high-level member of his field, R11 mentions his time spent immersed in mathematics:

> … I think I studied around 15 or 16 hours a day. Now I do it less, I study around 14 hours, but the whole day, from Monday to Sunday I dedicate it to mathematics. You can imagine the way my wife fights with me over that; she says that I'm working all the time on mathematics (R11—translated from Spanish).

Yee's (2006) study of MMORPG players found that time investment was a strong characteristic of major players. According to his sample of over 30,000 players, among the most successful players 8% claim to spend at least 40 hours per week in their virtual worlds. An astonishing 70% spend at least 10 continu-

ous hours in a sitting in their virtual worlds. His study also found that 18% of users reported that their high use caused academic, health, financial or relationship problems, with the amount of game time correlated with the amount of problems reported.

Worldwide Collaboration, Participation, and Advancement

As in MMORPGs, science is comprised of vast communities of characters cooperating and working together from all over the world, as a number of our subjects commented on. For examples,

> I want to establish relationships with other members of the physics community. … When you publish in the sciences you feel proud when other people quote your work. This is probably the most important step. Now after 10 years, I received 12 references for a more theoretical article I wrote in 1998… The truth is it is very exciting (R5—original English).

> Yes, this is, um let me explain to you. Ok … I think that we are part of a community, a scientific community, and this community wants to work to increase knowledge, in this case for physics, and the best way to increase knowledge, is to, publish your ideas. And this community is going to do a criticism of this idea, so it's a fundamental part for increasing knowledge, so I think that the, the need for publication is this process. So we can say "*granito de arena,"* how do you say? (R1—translated from Spanish).

In MMORPGs the means to progress or advance require increasing cooperation or dependency on other users (Yee, 2006), which matches closely the comments of our interviewees.

> So I started working here as a research professor and from here I continued working as a professor. And the things involved, I think that back then when I had an idea of the type of research I wanted to do, I think it was clearly defined, but I lacked two things, I didn't have the experience nor the detailed technical information of what I had to do. … But at that moment it was clear to me, that is the reason why I do

> this type of research… . at that moment I had what is called a master's in science, and one is able then to be a research assistant. … But we can say that from there came two or three other stages that in my academic life … [etc.] … I was chief director of the faculty, I've been coordinator of everything you can think of, of the postgraduates here in the faculty, and so on, I have done everything that is needed to be done … (R12—translated from Spanish).

Talking about his most recent article associated with an experiment in CERN, R5 comments:

> And … these collaborations … if your name is on these lists, it means you did something … good for this … job. But … this is the first paper … we are … planning on having … hundreds of them, like these. And … this first one is the result of more than ten years of … work, many many people collaborated in it, so this is it, this is it, it is fifteen pages long, the first … four are just names and institutions … here we have the place where our experiment is. … That's … ALICE and ATLAS and CMS. ATLAS has three thousand four hundred collaborators. … I'm also very proud, see? We are the institution number 83, 83 out of 113 institutions. Russia, Rumania, China, Germany, the States, Poland, Netherlands, Italy, France, South Korea, Spain (R5—original English).

Being in the Game: "Flow" from Advanced Immersive States

The isolation from immediate demands the scientists reported as facilitative for high level engagement appears to be setting the conditions for flow experiences (Csikzsentmihalyi, 1988) that occur within the state of total immersion. It is characterized by momentary or fleeting suspensions of time and physical reality. "Flow … is an extreme experience where goals, challenge and skill converge. As such flow is an all or nothing experience" (Sanders & Cairn, 2010, p. 1—pdf version). Flow is also easily lost when interruptions or distractions occur (Brown & Cairns, 2004).

When asked whether they have experienced such moments when working, the scientists all responded in the affirmative, but also acknowledge the temporality and the dependence on certain conditions to sustain the experience.

> Of course but that only happens if things are going well, otherwise the time passes slowly. … Sometimes because I'm normal only once in a while I get that ecstasy … [and when it does happen], I am sorry when I have to stop and return home (R12—translated from Spanish).

The ability to work at these levels and attain flow is associated with extreme pleasure and levels of concentration so intense that time and reality are suspended, but when it is over and reality resumes, feelings of disorientation and physical exhaustion can result. However, the euphoric feelings of flow are sirens' calls to return again and again.

Complex Cognitive Processes

Players with high levels of expertise can experience flow in situations that call for higher levels of challenge which engage increasingly complex cognitive processes (Prensky, 2003).

Writing likewise engages complex, multiple and simultaneous actions (Torrance & Galbraith, 2005). R6 expressed this well:

> Oh, I, I think that happens also in Spanish. I hold a lot of emotion when I write, I get tired, exhausted when I write, in English and in Spanish. Because I think a lot, and sometimes because, one of your questions … I cannot find the correct words to express something and I say, how can I do it? How can I express this? And I think it's not because of the writing, it's because of what I want to express, to say better and better. Yes, I feel a lot of emotion when I write … It's always a challenge to write ... like yesterday I was finishing a report from last year, and I knew that I have to write ... an acknowledgment to the ... financial organization who gave us the support to do this and I was trying to say "Thank you" in a very formal way and I was very stressed, trying to say, well, not saying thank you very much ... My problem was to give the correct portion of credits to everybody. That was the difficult part.
>
> Q: That's quite a challenge, isn't it? Do you generally like challenges?
>
> R6: Yes.

FINAL COMMENT

Ultimately the game of science is played on the game board of publication, and entering more deeply into the publication system draws one more deeply into the game and the dispositions of the game-player. Communication is the center of the game: "what you want is that others write that what you wrote was right" (Zamora-Bonilla, 2010, p. 9). How these scientists reached this point of engagement and overcame the obstacles that language created for their total immersion in the international game of science—and what this might mean for helping early career researchers get caught up in the game—is the subject of a future publication.

REFERENCES

Bazerman, C., Keranen, N., & Encinas, F. (in press). Facilitated immersion at a distance in second language scientific writing. In M. Castello & C. Donahue (Eds.), *University writing: Selves and texts in academic societies.* Bradford, UK: Emerald.

Bereiter, C. (1995). A dispositional view of transfer. In A. McKeough, J. Lupert, & A. Marini (Eds.), *Teaching for transfer: Fostering generalization in learning* (pp. 21-34). Mahwah, NJ: Erlbaum.

Brown, E., & Cairns, P. (2004, April). A grounded investigation of game immersion. Paper presented at CHI 2004, Vienna, Austria.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches.* London: Sage.

Csikszentmihalyi, M. (1988). The flow experience and its significance of human psychology. In M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 15-35). Cambridge, UK: Cambridge University Press.

Gordon, D., & Dawes, G. (2005). *Expanding your world: Modeling the structure of experience*. Tucson, AZ: Desert Rain.

Jennett, C., Cox, A. L., & Cairns, P. (2009, April). Investigating computer game immersion and the component real world disassociation. Conference paper presented at CHI 2009, Boston, MA.

Keranen, N. (2008). A multi-theoretical mixed-methods approach to investigating research engagement by university ELT staff (Unpublished doctoral dissertation). Lancaster University: United Kingdom.

Lieblich, A., Tuval-Mashiach, R., & Zilber, T. (1998). *Narrative research: Reading, analysis, and interpretation.* London: Sage.

Merton, R. K. (1968). The Matthew effect in science. *Science, 159*(3810), 56-63. DOI: 10.1126/science.159.3810.56

Popper, K. R. (1959). *The logic of scientific discovery.* New York: Basic Books.

Prensky, M. (2003). Digital game-based learning. *ACM Computers in Entertainment, 1*(1), 1-4.

Russell, D., & Harms, P. (2010). Genre, media, and communicating to learn in the disciplines: Vygotskian developmental theory and North American genre theory, *Revista Signos, 43,* 227-248.

Sanders, T., & Cairn, P. (2010, September). *Time perception, immersion and music in videogames.* Conference paper presented at HCI 2010, Dundee, Scotland.

Torrance, M., & Galbraith, D. (2005). The processing demands of writing. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research.* New York: Guilford.

Varela, F. J., & Shear, J. (1999). First person methodologies: What, why, how? *Journal of Consciousness Studies, 6*(2-3), 1-14.

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence, 7*(3), 225-240.

Yee, N. (2006). The psychology of MMORPGs: Emotional investment, motivations, relationship formation, and problematic usage. In R. Schroder & A. Axelsson (Eds.), *Avatars at work and play: Collaboration and interaction in shared virtual environments* (pp. 187-207). London: Springer-Verlag. Retrieved from http://vhil.stanford.edu/pubs/2006/yee-psychology-mmorpg.pdf.

Zamora-Bonilla, J. (2010). Science : The rules of the game. *Logic Journal of the IGPL, 18*(2), 294-307.