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Introduction to Special Section On the relations between schooling and local knowledge

1.- Introduction

Articles in this Special Section deal with the interactions between schooling, or formal education, and local knowledge, defined here as a socially transmitted and accumulated system of shared knowledge, beliefs, and/or practices that vary systematically across groups, allow people to adapt to their local environment (Boyd and Richerson 2005). Most articles specifically address local ecological knowledge. While schooling is nowadays a predominant way of socialization, for most part of human history individuals have become socialized in the knowledge, customs and mores of their society without schooling (Atran & Sperber 1991; Serpell 1993; Ohmagari & Berkes 1997). The acquisition of such cultural knowledge allows people to become competent social agents and to adapt to a range of environments (Boyd and Richerson 2005). This is still the case today in many remote regions of the world where schools are mostly deficient, rare, or simply do not exist. In such settings, the introduction of formal schooling overlaps with an already complex system of knowledge acquisition. When children's daily activities are rescheduled to accommodate school attendance, opportunities for acquiring local knowledge may change as well. Facing two different knowledge acquisition systems, children –and parents- need to take decisions on time and resource investments. What considerations drive those decisions? What are the short-term and the long-term consequences of those investments for the individual? And for their societies? Can we devise ways to minimize the costs and maximize the benefits derived from the interactions of both systems of knowledge acquisition? The articles in this Special Section explore, in one way or another, such questions.

This introduction has three parts. In the first part, I provide a brief summary of previous research on the synergies and trade-offs between local knowledge and schooling. While this is not the place for an exhaustive review, the summary review will help the reader contextualize the articles in this Special Section. In section two, I provide an overview of the current topics of research and how the articles in this Special Section address them. In the last section, I discuss some issues in the future research agenda that come out from the papers included in this Special Section.

2.- Local knowledge and schooling: What do we know?

Over the past decade, a number of studies have examined the interactions between local knowledge systems and schooling. Several important findings come out from this body of research.

A first important finding of the research on schooling and local knowledge is that, when analyzed independently, both forms of knowledge acquisition provide returns. Schooling is a well-documented means of improving the overall welfare of individuals and societies (Wolhuter 2007; World Bank 2011). Since the seminal work of Theodore Schultz (1960), a long line of research has proved that returns to modern human capital – schooling, and academic skills –are large and positive (Chiswick *et al.* 2000; Card 2001; Psacharopoulos & Patrinos 2004). And this is so even for indigenous populations and for low levels of schooling. Schooling produces tangible benefits both through cognitive development (e.g.,

Chiswick *et al.* 2000) and through socialization and the acquisition of non cognitive skills learned in school (e.g., Bowles & Gintis 2002; Lleras 2008).

Research has also shown that local knowledge, and specifically local ecological knowledge, provides societies with many benefits important for wellbeing and survival, such as helping to deal with pest infestations, cope with weather shocks, adapt to climatic change, select cultivars, manage natural resources, and enhance health and nutritional status (e.g., Etkin 2000; Bentley & Rodriguez 2001; Berkes & Jolly 2002; Perales *et al.* 2005; Gómez-Baggethun *et al.* 2012). Furthermore, research using the human capital approach to the study of local ecological knowledge also confirms that this type of knowledge produces positive returns to the individual in the same way that schooling and the skills and behaviors learned in school do (McDade *et al.* 2007; Reyes-García *et al.* 2008).

A second important finding in the literature is that, whether we talk about academic or local knowledge, the acquisition of any knowledge system follows complex pathways. For example, research suggests that children can acquire academic knowledge outside school settings, such as when working in trading or other occupations that require practical mathematical skills (Hull & Schultz 2001). Conversely, at school, children do not only learn academic skills, but they also acquire the cultural rules about what it means to be a productive social agent, how to follow hierarchy or how to work in teams (Bowles & Gintis 2002). The acquisition of local knowledge follows similarly complex pathways intermingling hands-on experience, interactions, and direct observation of adults, peers, and siblings that occur during different work and play activities (Setalaphruk & Price 2007; Reyes-García *et al.* 2009; Demps *et al.* 2012).

A third finding of this body of research is that use of time seems to be a good predictor of knowledge acquisition (Morelli *et al.* 2003). Cultural settings determine how children spend their day and whom they are around. This, in turn, determines children's potential learning opportunities (Whiting 1980; Henrich & Broesch 2011). The type of activity children participate in (i.e., going to school, helping their parents in productive activities, playing with their siblings, engaging in academic activities after school), and the amount of time they invest in each activity might affect the type of knowledge they acquire. Since most environmental knowledge is acquired during childhood (Hunn 2002), formal education systems that remove children away from this learning context may inhibit their capacity to acquire environmental knowledge. In that sense, trade-offs seem to exist between time allocated to schooling versus time allocated to the acquisition of knowledge about local environments and the mastery of skills for making a living in a given environment (Sternberg *et al.* 2001).

The idea that trade-off exists between both learning systems take us to a fourth important finding in the literature: the associations between local knowledge and schooling are complex and do not seem to be unidirectional. On the one hand, researchers have suggested that schooling and the academic skills learned in school are among the main causes for the loss of local knowledge, as time and resources spent in school detract from time and resources spent acquiring local knowledge (Sternberg 1997; Sternberg *et al.* 2001; Quinlan & Quinlan 2007). On the other hand, researchers have also argued that local knowledge can complement schooling, as the inclusion of local bodies of knowledge in the formal curricula helps to improve learning by making school content more relevant and by providing a better sense of place and identity to pupils (Gilliland 1995; Taylor & Mulhall 2001; Castagno & Braboy 2008). But the inclusion of local knowledge content in school curricula is not straightforward. McCarter & Gavin (2011) highlight several barriers for the inclusion of local knowledge in the school curricula, namely i) conflicts regarding knowledge ownership, specially in context where knowledge is a source of wealth and prestige; ii) differences in

teaching systems, as the instruction of local knowledge, typically in setting away from the classroom and from teachers of varied age and relations to the learner, greatly differs from school instruction; and iii) conflicts related to cultural diversity, when children with diverse cultural backgrounds are educated in the same classroom. Several researchers go even further to argue that the attempt to include local knowledge on the school curricula might in fact de-validate it by separating the knowledge from its cultural context (Thaman 2000; Sundar 2002; Bates 2009).

A last finding on the interactions between local knowledge and schooling relates to the motivations that explain time and resource investments in one system of knowledge acquisition versus the other. Results from previous research suggest that people prioritize time and resource investments on the knowledge system that seems to provide the largest returns within their particular contexts. For example, researchers have argued that in places where the quality of schooling is poor (i.e., limited number of teaching hours, bad school infrastructure, low teacher's level of schooling, lack of textbooks), parents might discourage children from going to school, as they might perceive that children's time is better invested in acquiring knowledge related to subsistence activities (e.g. hunting and fishing or agricultural work). Low quality schooling offers only a fragmentary and weak body of academic knowledge and of exposition to mainstream cultural norms that might not be enough to provide positive returns (Hernandez-Zavala *et al.* 2006; Patrinos & Skoufias 2007). So, in such contexts, people might redirect time investments to the acquisition of other forms of knowledge. Similarly, the scarcity of opportunities for engaging in paid labor requiring academic knowledge also reduces the incentives to invest in the accumulation of such type of knowledge (Serpell 1993; Jensen & Nielsen 1997).

In sum, previous research has provided important insights on the reasons that motivate people's investments in knowledge acquisition. Previous research has also helped us understand the importance of analyzing content and context in both types of knowledge systems, as well as the need to focus on the use of time. All this findings provide important clues for research. Clues that, in one way or another, are followed by the articles included in this Special Section.

3.- Local knowledge and schooling: Current research topics and the contributions in this Special Section

Much of the debate on the interactions between schooling and local knowledge revolves around their potential complementarity. Answering this question, however, requires a deep understanding of indigenous learning systems, a not fully developed research topic (but see Hewlett and Lamb 2005). Most previous works on local knowledge systems have provided a somehow static view of this body of knowledge (see Gómez-Baggethun & Reyes-García (In press) for a debate on the topic). We know, however, that in fact such knowledge systems are dynamic, with knowledge constantly being lost and gained through innovations and cultural borrowing. One of the articles in this Special Section addresses the issue of change in local knowledge systems. Using empirical data collected among the Tsimane', an hunter-horticulturalist society in the Bolivian Amazon, Reyes-García and coauthors examine changes in different domains of local knowledge under the idea that changes on those different domains should parallel changes on local livelihood activities. The authors find that different domains of local ecological knowledge experience different secular changes: medicinal knowledge and wild edible knowledge experience a secular decline; canoe building knowledge and firewood knowledge remain constant across generations; and house building knowledge experiences a slight secular increase. Analyzing those trends in the context of other changes in Tsimane' livelihoods, the authors highlight how changes in Tsimane' local knowledge, in fact, respond to the particular needs of a society in a given

point of time. Although the article does not directly address the relations between schooling and local knowledge, it deepens our understanding of indigenous knowledge systems by highlighting the interactions between local knowledge systems and local livelihoods. Such insights are useful in understanding of indigenous knowledge systems and could be useful in applied programs oriented to mitigate conflicts between acquisition of local knowledge and schooling.

A second important current topic of research relates to children's actual use of time. Past research has focused on the dichotomy between schooling and the learning of local knowledge through work and play (Sternberg *et al.* 2001; Reyes-García *et al.* 2008). But the current globalization process that touches the lifestyles of most indigenous and rural societies has brought, in addition to schooling, many other activities that modify children's and adults' use of time. As schooling, modern activities such as non-traditional domestic activities (i.e., washing clothes and dishes) and modern leisure (i.e., football, listening to the radio, watching television, traveling to town) modify people's use of time and can – therefore- affect the acquisition of local knowledge. But differently from schooling, time spent in such modern activities might affect overall learning, as the time children devote to these activities reduces their opportunities to learn both local knowledge and academic knowledge and skills. In this regard, it is important to have a better understanding of children's (and adolescents') use of time beyond the time invested in the acquisition of academic or local knowledge. It is also important to understand adults' use of time, as the activities performed by adults affect children's learning opportunities. Finally, it is also critical to have a better understanding of the returns provided by such activities, in relation to the returns provided by schooling or the acquisition of local knowledge. Two articles in this Special Section address this important topic.

Ruiz-Mallén and colleagues document and analyze time budgets of children, adolescents, and adults from two Amazonian small-scale indigenous societies: the Kayapó and the Araweté. They describe patterns of time use and differences in children's time budgets based on gender, age, and indigenous group. The studied children rarely went to school; they spent half of their daylight time playing and undertaking subsistence work, although their contribution to household income was extremely low. One of the interesting findings of this work is that overall children between 6 and 12 years of age spend about 17% of their daylight time in modern activities such as playing soccer and traveling to town.

Why do children and adolescents spend so much time in such activities? Do those time investments provide larger returns than the acquisition of academic or local ecological knowledge? Morsello and Ruiz-Mallén partially address such question. In an analysis using data from three highly autarkic foraging-horticultural groups of the Brazilian Amazon, the authors evaluate the monetary returns to schooling compared to the monetary returns to exposure to the dominant society through traveling to urban areas. The analysis is based on the idea that activities that occur out of school might contribute to the acquisition of some of the skills that people typically acquire at school settings, thus enhancing the individuals' ability to deal with the Brazilian society and therefore to access paid jobs. They find that the frequency of exposure to the dominant society through traveling bears a positive association with monetary income after controlling for covariates (e.g., age, sex, proficiency speaking Portuguese). The results from this work suggest that, for the studied groups, traveling to local towns is specially important among people with little previous travel experience, whereas for the group with more travel experience is the travel to more distant locations what bears a positive association with monetary income. This study shows that, for indigenous peoples, socialization into the dominant society through travel experiences may provide another mean of learning the behaviors and skills which are valued by the dominant society. It is plausible that people in indigenous societies prefer to acquire skills through

such mechanisms, as they are based on oral transmission and imitation of peers, and therefore resemble more traditional learning systems. The findings extend our understanding of how activities other than schooling or engagement in traditional activities impacts local livelihoods and may affect indigenous people's integration into mainstream society.

A third topic of current research on the interactions between schooling and local knowledge addresses the circumstances under which those two knowledge systems are complementary. For example, although overall the acquisition of schooling seems to undermine the acquisition of local ecological knowledge, its impact seems to vary depending on the circumstances (Reyes-García *et al.* 2010). Since the acquisition of both bodies of knowledge is sequential and starts at early age, one could wonder whether there are especially sensitive periods of learning when one body of knowledge or the other should be prioritized. We also need more research that help us understand the reasons why contextualized learning improves the acquisition of academic knowledge, so we are in a better position to design contextualized programs that, in addition to improve academic learning, also contribute to neutralize the negative effects of schooling on local ecological knowledge. Can other forms of education (extra-curricular activities) provide the contextualized education that school programs do not seem to be able to provide? Two articles in this Special Section provide insight into the pathways to better integrate local knowledge into the school settings.

Cruz-García and Howard discuss an extra-curricular educational program as an alternative pathway for enhancing local ecological knowledge. Specifically, the authors examine the impact of the extra-curricular educational program on children's knowledge of wild food plants in Wayanad (Western Ghats, India). The program was designed to encourage indigenous and non-indigenous children to learn from each other and their community, and to value local natural resources like wild edibles, many of which were locally stigmatized. This article shows that the extra-curricular program enhanced children's knowledge of wild food plants, as children who participated in the program were able to identify twice as many wild edible plants than those who did not participate. Also, more children who participated in the program reported that they gathered wild food plants compared with those who did not participate. The article highlights that extra-curricular educational programs could be an alternative to fight stigmatization and reinforce the acquisition of local knowledge in contexts where this body of knowledge is neglected by formal schooling.

Ladio and colleagues take a different angle to the same subject. The authors notice that teachers are key players in the transmission of knowledge related to the environment, but that little research has been done to assess teachers' own level of local ecological knowledge and how this body of knowledge is integrated into the teaching process. To start filling this gap, the authors analyze the perception and knowledge of wild edible plants possessed by teachers of different age classes working in rural and urban areas of arid Patagonia. The authors find that the local ecological knowledge possessed by Patagonian teachers is mostly related to medicinal uses of plants and highly biased towards plants of relevant global significance and towards those easily found in the landscape (in the close surroundings). As the authors argue, knowledge held by the teachers could play a key role in contextualizing locally relevant information, in part through linking the theoretical knowledge of the classroom with the personal, practical wisdom of the local community, empowering pupils and reinforcing their cultural identity.

A final topic of research on the interactions between LEK and schooling addressed by articles in this Special Section relates to the issues that play a role in people's time investment. As mentioned before, we know from previous research that scarcity of job opportunities and low quality of schooling can play a role in time and resource investments. Those decisions include considerations on the short-term costs of schooling (including the

fees and the opportunity costs of potential revenues for children's work) versus the short-term benefits of not attending schooling (and rather investing in labor or in the acquisition of the local knowledge that might provide more immediate returns). One of the articles in this Special Section analyzes this subject.

In their article on the associations between household responsibilities and academic competencies in Zambia, Reich and colleagues investigate the impact of home responsibilities (i.e., chores and work) on the reading and mathematics skills of children in-school and out-of-school in rural and periurban communities. They find that the children in-school performed better in domains of adaptive behavior and on assessments of academic achievement (i.e., mathematics, reading) than out-of-school children. However, they also found that home responsibilities (i.e., chores, work) were a positive predictor for the academic performance of the children out-of-school, but a negative predictor for the children in-school. The authors interpret their findings arguing that for in-school children chores take time away from the studies, whereas for out-of-school children chores provide some mathematics exposure. Overall, the article highlights the complex interactions between schooling and local learning systems.

4.- Setting the agenda for future research

Articles in this Special Section address some of the current topics of the research analyzing the complementarities and trade-offs between school and local knowledge systems. But the articles presented here also help move the field forward by suggesting new directions of research. In this section, I highlight three pressing issues in this research agenda that come out of the articles presented here.

First, we need more research comparing the returns provided to investments in schooling versus investments in the acquisition of local knowledge, as well as versus investments in other –non-traditional– activities. We need a better understanding of where, when and how trade-offs occur between the different activities nowadays available to children and adults in indigenous and rural areas. Which type of knowledge provides higher returns? What contextual factors affect those returns? Do alternative uses of time (i.e., watching TV) compete with the acquisition of both local knowledge systems and schooling? And if so, what are the long-term consequences? Longitudinal studies on children's, adolescents', and adults' time budgets would be of great value to assess the returns to time investments in different activities.

Second, we need to expand the research on contextualized learning. We know that local knowledge has the potential to add value to formal education systems by contextualizing the content of curricular delivery (McCarter & Gavin 2011). We now need to move forward and examine aspects of the learning process other than content that might improve the contextualization of the curricula. The articles in this Special Section suggest that this body of research needs to be expanded to include process. For example, integrating local knowledge into formal school may shift the mode of knowledge transmission from vertical (from parents to offspring) or horizontal (within peer groups) to oblique (one instructor from the parental generation to many younger learners). Since the transmission pathway influences the information being transmitted, the incorporation of local knowledge into the school system may result in a fundamental change in the structure and content of the local knowledge. A crucial aspect to be analyzed is the shift from oral to written forms of knowledge transmission (Leonti 2011). Another example of the importance of procedural aspects in contextualized learning relates to values. As Cruz-García and Howard (this number) have pointed, knowledge and values are not independent, and thus integrating

specific aspects of local knowledge in the school curriculum might not be very successful if this type of knowledge is socially stigmatized.

Third, we need to expand research addressing the challenges found in including local knowledge in formal education, so the integration of this body of knowledge in formal education systems does not impact its integrity. While contextualized learning seems to improve academic knowledge acquisition, it does not seem to strengthen local knowledge systems (McCarter & Gavin 2011). Can we design school curricula that minimizes the trade-offs between schooling and local ecological knowledge acquisition? McCarter & Gavin (2011) propose that the incorporation of local views on the school curricula and the empowerment of local ecological knowledge holders might work on this direction. Some experiences do suggest that involving the large educational community (local stakeholders, teachers, students) in contextualizing school learning activities might mitigate the impact of schooling on local structures (Ruiz-Mallen et al. 2010). But we definitely need more research in that direction.

Answering such questions becomes a pressing issue as states and international organizations increase the efforts to provide universal education (see for example Target 2.A of the United Nation's Millennium Development Goal) and as scientists document the erosion of local knowledge systems and cultural diversity (Maffi 2002; Reyes-García *et al.* in press). A major challenge ahead lays in re-shaping school curricula oriented to indigenous children and children living in rural areas to include not only the content, but also the context that societies have put in place for the transmission of their local knowledge. Articles in this Special Section provide a step forward in that direction.

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