

Looking from a CHAT-IT perspective to undergraduate Mexican physics: organizational trajectories or professors as agents of change?

Ajda Kahveci

Received: 1 March 2010 / Accepted: 1 March 2010 / Published online: 3 April 2010
© Springer Science+Business Media B.V. 2010

Abstract Recent elaborations on cultural-historical activity theory (CHAT) (Engeström et al., eds., *Perspectives on activity theory*. New York: Cambridge University Press, 1999) and its relation to organizational theories have produced a theoretical amalgam of these earlier ideas, which allow for the exploration of learning in formal organizational contexts such as schools. In this paper I reflect on Candela's work situated in undergraduate Mexican physics by drawing attention to the CHAT-IT framework (Ogawa et al., *Educational Researcher* 37(2):83–95, 2008) as a viable lens. I suggest that it is important to understand the historical development of the Mexican university as an educational organization as well as the role of physics professors as agents of change whose practices contribute to not only breaking classroom walls but also to transforming the organization affecting future activity systems.

Keywords CHAT-IT · Educational organization · Transformation

Resumen Ejecutivo Desarrollos recientes de la teoría histórico-cultural de la actividad (CHAT, en inglés) (Engeström et al., eds., *Perspectives on activity theory*. New York: Cambridge University Press, 1999) y de su relación con teorías de las organizaciones (IT, en inglés) han producido una amalgama de ideas que permiten explorar el aprendizaje en contextos de organizaciones formales como son las escuelas. En este artículo yo reflexiono sobre el trabajo de Antonia Candela (Ver Candela en este foro) acerca de los estudiantes de física en México, y propongo el marco teórico de CHAT-IT (Ogawa et al., *Educational Researcher*, 37(2):83–95, 2008) como una lente posible para el análisis. Con esto me planteo dos propósitos. El primero es mostrar que, desde mi punto de vista, esta aproximación teórica, por manejar una perspectiva más amplia, es útil para comprender el fenómeno que se aborda. El segundo, es el de ampliar los esfuerzos de Ogawa y su grupo,

This is a review essay of: Candela, A. Time and space: Undergraduate physics in motion. *Cultural Studies of Science Education*.

A. Kahveci (✉)
Chemistry Education Division, Faculty of Education, Çanakkale Onsekiz Mart University,
Çanakkale, Turkey
e-mail: ajda.kahveci@gmail.com

para establecer colaboraciones multidisciplinares entre colegas que estudian el aprendizaje e investigadores que estudian las organizaciones educativas. El enfoque CHAT-IT fue construido para dar cuenta de los elementos de una organización que se vuelven fundamentales en los contextos sociales de aprendizaje. El nuevo marco permite “ligar los escenarios inmediatos en los que ocurre el aprendizaje a los contextos sociales de las organizaciones y a las fuerzas sociales y culturales que le dan forma a las organizaciones” (Ogawa et al. 2008, p. 84). Esta perspectiva elabora sobre la teoría de Engeström “añadiéndole elementos de IT que reflejan cómo se desarrollan las instituciones en contextos de actividad” (p. 90). Candela adopta la perspectiva de Nespore (Pedagogy, Culture and Society 12:309–326, 2004) en la que la enseñanza y el aprendizaje son procesos complejos en un contexto de múltiples órdenes espacio-temporales, y contrasta las trayectorias y los itinerarios de los estudiantes mexicanos de física con los de EU. Dos factores principales aparecen como los que influyen en la construcción que hacen los estudiantes mexicanos de sus prácticas más autónomas: la naturaleza de las trayectorias organizacionales de la física universitaria y las características culturales de esas trayectorias e itinerarios. El trabajo de Candela también muestra que las prácticas instruccionales de un profesor mexicano son la principal fuerza motora para que los alumnos desarrollen autonomía para moverse a lo largo de redes disciplinares, tales como las de física. Por su naturaleza, el enfoque de CHAT-IT parece prometedor en cuanto a identificar los rasgos organizacionales y culturales de las trayectorias y los itinerarios de los estudiantes de la licenciatura de física para el estudio etnográfico de Candela. A la luz de este enfoque, sugiero que es importante comprender el desarrollo histórico de la universidad mexicana vista como una organización educativa y las influencias institucionales sobre este desarrollo que sirven de base para aprovechar las oportunidades educativas. En segundo lugar, el caso del profesor mexicano de física es prometedor como una potencial contribución a un área poco investigada. De acuerdo a Ogawa et al. (2008), “Es difícil encontrar estudios que documenten situaciones en las que los sujetos o los participantes hayan transformado no sólo a las organizaciones, sino al medio institucional alterando el sistema de actividad inmediato” (p. 92). En este sentido, el enfoque CHAT-IT aporta una lente posible para analizar si los profesores mexicanos de física pueden contemplarse como agentes de cambio cuyas prácticas contribuyan, no sólo a romper las paredes del aula, sino a transformar la organización influyendo, incluso, sobre los futuros sistemas de actividad.

Genişletilmiş Özet Kültürel-tarihsel aktivite teorisi (*cultural-historical activity theory [CHAT]*) (Engeström et al., eds., Perspectives on activity theory. New York: Cambridge University Press, 1999) ve teorinin organizasyonel teorilerle (*institutional theory [IT]*) olan ilişkisinin son zamanlarda irdelenmesi bu teorilerden oluşan kuramsal (teorik) bir alayım üretmiştir. Bu alayım öğrenmenin okul gibi formel organizasyonel bağlamalarda araştırılması sağlamıştır. Bu makalede, CHAT-IT çerçevesine (Ogawa et al., Educational Researcher, 37(2):83–95, 2008) geçerli bir bakış açısı olarak dikkat çekip, Meksikan üniversite fiziği alanında konumlanmış olan Candela'nın çalışması üzerine düşüncelerimi yazdım. İki amacım var. Birincisi, bana göre, bu yaklaşım daha kapsamlı bir bakış açısı sunarak, sözkonusu olguyu anlamada daha verimli olacaktır. İkinci amacım, Ogawa ve arkadaşlarının öğrenmeyi ve eğitim organizasyonlarını araştıran bilim insanları arasındaki multidisipliner işbirliğini başlatan çalışmalarını daha da genişletmek niteliğindedir. CHAT-IT çerçevesi öğrenmenin sosyal bağlamlarında kaçınılmaz olarak önemli hale gelen organizasyon öğelerinin de dikkate alınması amacıyla oluşturulmuştur. Yeni çerçeve, kişinin “organizasyonlara şekil veren sosyal ve kültürel etkiler (normlar) ile

bu organizasyonların sosyal bağlamlarını öğrenmenin meydana geldiği hali hazırdaki öğrenme ortamlarına bağlanmasına olanak vermektedir” (Ogawa ve ark., 2008, s. 84). Bu, “kurumların aktivite bağlamlarına nasıl ‘taşındığını’ yansıtmak üzere IT’den öğeler ekleyerek” (s. 90) Engeström teorisini yapılandırmaktadır. Candela, öğrenme ve öğretmenin çoklu uzam-zamansal bağlamda karmaşık bir yapıda olduğunu ifade eden Nespor’un (Pedagogy, Culture and Society 12:309–326, 2004) bakış açısını benimsemiş ve Meksikalı fizik öğrencilerinin rota ve izledikleri yolları Amerikalı öğrencilerinininkilerle karşılaştırmıştır. Meksikalı öğrencilerin daha otonom (kendi kendine) eylemler geliştirmelerinde iki temel faktörün etkin olduğu görülmüştür: bunlar üniversite fiziğinin organizasyonel rotasının doğası ve bu rota ve izlenen yolların kültürel özellikleridir. Candela’nın çalışması ayrıca fizik profesörlerinin öğretim uygulamalarının öğrencilerin fizik gibi bir disipliner iletişim ağında hareket etmek üzere otonom yeterlilik geliştirmelerinde ana itici kuvvet olduğunu ortaya koymuştur. Doğası itibarıyla CHAT-IT çerçevesi, Candela’nın etnografik çalışmasındaki Meksikalı üniversite fizik öğrencilerinin rotaları ve izledikleri yolların organizasyonel ve kültürel özelliklerini tespit etmede işe yarayacak bir konumdur. Bu çerçevenin ışığında, Meksikan üniversitesinin bir eğitim organizasyonu olarak tarihi gelişimini ve sunulan eğitim olanaklarının kaynağı olan bu gelişimin üzerindeki kurumsal etkileri anlamanın önemli olduğunu öneriyorum. İkinci olarak, Meksikalı fizik profesörlerinin durumu ile ilgili yeterince araştırma yapılmamış olması itibarıyla, bu alandaki çalışmalar dikkate değerdir. Ogawa ve ark. (2008)’a göre, “Denek veya katılımcıların, kendi halihazırdaki aktivite sistemlerini değiştirerek, bırakın kurumsal çevreleri, organizasyonları dönüştürdüğü durumları belgeleyen çalışmaları bulmak güçtür.” (s. 92). Bu anlamda, uygulamaları sadece sınıfların duvarlarını “yikan” değil aynı zamanda organizasyonu dönüştüren ve gelecekteki aktivite sistemlerini etkileyen Meksikalı profesörlerin değişim öznesi olup olmadıklarının değerlendirilebilmesi konusunda CHAT-IT geçerli bir bakıştır.

In this paper I reflect on Candela’s work on exploring Mexican undergraduate students’ learning trajectories and itineraries in physics from a time–space perspective. I do this by bringing to attention a novel theoretical framework (Ogawa et al. 2008) to analyze what happens in Mexican and US classrooms of undergraduate physics. I have two purposes. First, in my opinion, by enabling an extended perspective, this theoretical approach is fruitful in the understanding of the phenomena at hand. Second, I aim to extend Ogawa and friends’ efforts of initiating multidisciplinary collaboration among scholars who study learning and scholars who study educational organizations.

From a sociocultural point of view, Candela adopts Nespor’s (2004) perspective that teaching and learning is a complex process in a context of multiple spatio-temporal orders, or scales. In this view, learning is conceptualized as being able to move self and cultural tools through the time–space networks of a discipline. Candela emphasizes that in order for learning to happen, educational organizations construct trajectories for their students including material environments and representational artifacts such as classrooms and curricula, respectively. The author contrasts Mexican physics students’ trajectories and itineraries with those of US students.

Conclusions from the work suggest distinctions between the itineraries of these two groups of students. Mexican students seem to be more autonomous in constructing their own itineraries in physics while US students are forced to concentrate on a pre-determined formal training. The latter have also more limited opportunities to be involved in practitioners’ spaces. Two main factors appear to be influential in Mexican students’

constructions of more autonomous practices in classrooms with more porous walls: the nature of the organizational trajectories of university physics and the cultural features of these trajectories and itineraries.

Undergraduate Mexican physics from a CHAT-IT perspective

Recent elaborations on cultural-historical activity theory (CHAT) (Engeström et al. 1999) and its relation to organizational theories have produced a theoretical amalgam of these earlier ideas. Ogawa et al. (2008) proposed a comprehensive framework to understand learning in the context of formal organizations by combining elements from CHAT and Institutional Theory (IT). IT was originally developed by Leavitt (1965). The efforts of Ogawa et al. seem to have vast potential for opening new avenues for science education research since most science education research is conducted within the context or in relation to a formal educational organization, most often a school or college, as is the case of Candela's work. The CHAT-IT framework was constructed to account for the elements of organizations that inevitably become important in the social contexts of learning. Organizational elements such as goals, participants, technology and social structure (Leavitt 1965) are seen as common components of the CHAT and IT. The new framework allows one to "link the immediate settings in which learning occurs to the social contexts of organizations and to the social and cultural forces that shape organizations" (p. 84). It builds on Engeström's theory "by adding elements from IT to reflect how institutions are 'carried' to activity contexts" (p. 90). Mutually, the CHAT elements in the framework allow for understanding a possible institutionalized change occasionally initiated by the subjects in the activity system. Ogawa et al. (2008) provide a visual model for the CHAT-IT framework (Fig. 1) and describe its elements and relationships in the following words:

Subjects/participants employ artifacts/technology in their contexts to participate in object/goal-oriented activity. Subjects'/participants' use of artifacts/technologies is mediated by the norms of the communities/organizations that serve as the context for activity and by their formal structures, which include rules and division of labor. Communities/organizations adopt formal structures that reflect institutions, which are enacted and carried by *coercive*, *normative*, and *mimetic* mechanisms. The addition of institutional elements to the model illustrates that IT contributes to conceptualizing the links among societal values through institutional mechanisms to the core elements of formal organizations such as schools and museums, and thus to activity systems, which are the immediate social and cultural settings for learning. (p. 90, emphases original)

By nature, the CHAT-IT framework seems promising in identifying the organizational and cultural features of the trajectories and itineraries of Mexican physics undergraduate students in Candela's ethnographic study. Ogawa et al. (2008) claim a mutual relationship between CHAT and IT in terms of analytical power. In their view, just as IT needs CHAT to explain change and transformation, CHAT needs IT to examine activities in the context of formal organizations influenced by institutions through different mechanisms.

The undergraduate physics trajectories afforded to the students by the university in Mexico appear to be different than those in the US. In Candela's view, "cultural features related to the history of this school and the economic role of physics and technology within a dependent country could be part of the explanation for the differences" (p. 25). An IT perspective would be particularly useful here to explore these features as "IT contributes to

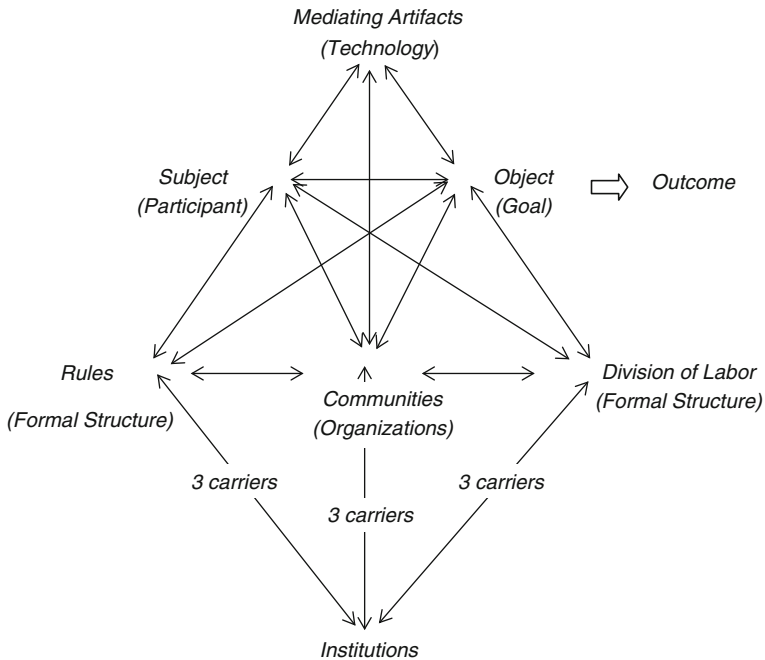


Fig. 1 The CHAT-IT framework. Adapted from Ogawa et al. (2008), p. 91

conceptualizing the links among societal values through institutional mechanisms to the core elements of formal organizations such as schools and museums, and thus to activity systems, which are the immediate social and cultural settings for learning” (Ogawa et al. 2008, p. 90).

According to Ogawa and friends, schools in the US were modeled after the factory in early nineteenth century when urbanization, industrialization and immigration were happening as the dramatic societal changes. Thus, contemporary US schools still enact the values and practices of this period with structural components such as classrooms, desks arranged in rows and textbooks followed by the teacher and students. Mexican classrooms, on the other hand, become nodes of the disciplinary networks where extended spaces and times are produced. The historical accounts and societal institutions in Mexico as well as the ways these institutions influence educational organizations such as universities is a potential area to be illuminated by a CHAT-IT perspective.

Candela’s work also reveals that Mexican professors’ instructional practices are predominantly the driving force in students’ developing autonomous competence to move along the disciplinary networks such as physics. In the paper it is documented that the professors do not assign a single textbook to be followed, instead, students are encouraged to examine a variety of sources including contemporary research articles as well as yet unsolved physics problems. Problem solving relating to different disciplinary networks, flexible class attendance and collective work leading to new social and professional relationships are among other instructional practices adopted by the physics professors. The activity of the professors, which is teaching physics through extended spaces and times of the discipline, becomes a critical and transformative one in a context of a formal educational organization. Instead of reproducing the factory model of schooling, the

Mexican physics professors seemingly engage in non-customary practices of teaching and in this way, act as agents of change.

From the perspective of CHAT, there are two continuously operating processes in an activity system: *Internalization* refers to “reproduction of culture,” and *externalization* means creating new artifacts for transformation. The notion of transformation is key in activity theory. Moreover, activity theorists criticize Lave and Wenger’s (1991) theory of legitimate peripheral transformation for its *temporal* dimension (Engeström and Miettinen 1999) where processes like criticism, innovation and initiation of change are left unquestioned. In the Mexican case, the professors not only assist their students to the community of physics practice but they also strive to break the classroom walls as well as the traditional notion of schooling. Such change at interpersonal level can alter routines and structures, and produce institutionalized change (Ogawa et al. 2008).

Concluding comments

Around the globe for the last two decades, following the lead of the US, efforts have been made to improve science teaching and learning in non-customary ways. For example, an inquiry approach to teaching and learning is considered to best reflect a quality science education, and thus, is promoted in various reform documents (e.g., National Research Council 2000). However, several educational researchers have observed that schools do not alter their basic structures in spite of adopting new curricula and instructional practices (Tressell 1994). Ogawa et al. (2008) imply that traditional school structure following the factory model is one factor constraining reform-based practices. So, how traditional is the university structure in which the Mexican case unfolds? Or, how does a non-traditional approach to physics teaching and learning fit within the existing university structure? As the CHAT-IT framework posits, it is important to understand the historical development of the Mexican university as an educational organization and the institutional influences on this development that serve as the bedrock of the educational opportunities afforded.

Second, the case of the Mexican physics professors is promising as a potential contribution to a less-researched area. According to Ogawa et al. (2008), “It is difficult to find studies that document instances where subjects or participants have transformed organizations, let alone institutional environments, by altering their immediate activity systems.” (p. 92). In this respect, the CHAT-IT framework is a viable lens to see if Mexican physics professors could be regarded as agents of change whose practices contribute to not only breaking classroom walls but also to transforming the organization and to also affecting future activity systems.

Acknowledgment I thank Alejandro J. Gallard for the reviewing opportunity and the editing work.

References

- Engeström, Y., & Miettinen, R. (1999). Introduction. In Y. Engeström, R. Miettinen, & R. Punamäki (Eds.), *Perspectives on activity theory* (pp. 1–16). New York: Cambridge University Press.
- Engeström, Y., Miettinen, R., & Punamäki, R. (Eds.). (1999). *Perspectives on activity theory*. New York: Cambridge University Press.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

- Leavitt, H. J. (1965). Applied organizational change in industry: Structural, technological, and humanistic approaches. In J. G. March (Ed.), *Handbook of organizations* (pp. 1144–1170). Chicago: Rand McNally.
- National Research Council. (2000). *Inquiry and the national science education standards*. Washington, D.C.: National Academy Press.
- Nespor, J. (2004). Educational scale-making. *Pedagogy, Culture and Society*, 12, 309–326.
- Ogawa, R. T., Crain, R., Loomis, M., & Ball, T. (2008). CHAT-IT: Toward conceptualizing learning in the context of formal organizations. *Educational Researcher*, 37(2), 83–95.
- Tressel, G. W. (1994). Thirty years of “improvement” in precollege math and science education. *Journal of Science Education and Technology*, 3, 77–88.

Author Biography

Ajda Kahveci earned her Ph.D. in Science Education at Florida State University in 2005. In her dissertation research she analyzed a women’s program in terms of its impact in encouraging undergraduate women to pursue science, mathematics and engineering majors. She employed mixed methodology approach, with particular emphasis on the cultural-historical activity theory. Currently she is assistant professor of chemistry education at Çanakkale Onsekiz Mart University, Turkey. She has participated in two leading research projects concerning pre- and in-service teacher education supported by the Scientific & Technological Research Council of Turkey. Her research interests include gender equity in science education, pre-service chemistry teacher education and conceptual understanding in chemistry. She has published her work in these areas in leading science education journals and has recently authored a book chapter on women’s education and career choices in Turkey.