Chapter 25

Developing a Project-Based CALL Environment With Technical Communication in an Exploratory 3D Printing Context

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ABSTRACT

Involving EFL students in 3D printing in a language classroom introduces the idea of project-based CALL, where different technology interfaces engage students in complex technical writing activities and social interactions in a fluid language-learning environment. This paper took an instructional approach to explaining how project-based CALL environment could be created with 3D printing based practices, combining technical communication with systems thinking, online research, 3D scanning, computer-aided design, sketch boarding and concept mapping, prototyping, and digital content management. Class performance in this collaborative, autonomous and social language-learning environment suggested that students were able to produce technical writing, prepare documentation, demonstrated critical thinking and brainstorming, and develop design and implementation strategies while handling 3D printing-enabled processes. Results and patterns of student engagement with technology indicated that project-based learning (PBL) approach in TC classroom is engaging, unique, realistic and feasible.

1. INTRODUCTION

The current trend in CALL seeks both to integrate the various language learning skills, and to integrate technology more fully into language teaching (Warschauer & Healey, 1998). Expectedly, one important factor that will influence the future of CALL is technological change (Warschauer, 2011). But a big challenge in CALL context is to integrate different types of emerging technology into a social language-learning environment and project application context without disrupting the natural flow of task-related interactions. Until now, few studies (if any) have been done in CALL on how 3D printing (additive manu-

facturing), as a revolutionary technology, could possibly re-shape English language learning in a social and project-related context. This exploratory study attempts to bridge that gap in the CALL literature. 3D printing-related technology represents the third industrial revolution in manufacturing (Council et al, 2014), with potential benefits in language acquisition, academic performance, team work, higher order thinking, learning motivation, and customized learning (Tsay & Brady, 2010; Rogers, 2003). This is a study on understanding how English is taught and learnt in a technical communication course dealing with 3D printing processes.

This article discusses if 3D printing related processes and technology could be used as language learning tools in a project situation where multiple devices and technologies are simultaneously handled. Language learning happens in the context of learning about and handling these different technologies and interfaces, and writing and presenting such information in an online environment. The idea is to explore if the 3D printing technology and processes could potentially immerse the learners in a realistic context and make the learning process enjoyable and the technology integrated in a way where it facilitates language learning. In such a scenario, the use of technology is purely random (based on need for the project), contextual and social, and language learning is immersed and disguised in the myriad of complex project-related interactions. It is important to develop such an idea of *Project-based CALL* because recent research suggests project-based CALL, with student involvement in authentic, and challenging tasks as its core, may help develop the complex English literacy and communication skills required for success in today's information age (Peiya, 2002).

3D printing related classroom facilitates language learning by involving students in complex sets of activities including collaborative learning, brainstorming, critical thinking, online research, shared document production, online exchange of ideas, CAD-based design, physical handling of equipment such as 3D scanners, apps, 3D printers, cartridges, concept mapping tools and understanding concepts of digital content management. With this *Project-based CALL* pedagogical approach, on the lines of what was suggested by Karpati (2009), students learn language as they become co-developers, harness collective intelligence, link services and resources, get control over ever-emerging data sources, and use software that goes beyond a single device. In this case, technologies have the immense potential to get students involved in contextual framing of language in unique and impromptu project-related contexts. This *Project-based CALL* environment, as discussed in this article has been designed such that individual roles are flexible and floating, and co-creation of activities are emergent in nature. Such a *Project-based CALL* approach is completely in tune with Web 2.0 and School 2.0 principles of collaborative, constructionist and connectivist learning paradigms, where an expandable community of learners creates knowledge, minimizes the role of instructors, where learners co-design their learning trajectory, and create, and develop their learning content. This focus on 3D printing in a *Project-based CALL* environment is an attempt to re-package and re-define the core features of Vygotsky's social interaction theory (Lantolf, Thorne and Poehner, 2015) and computer-supported collaborative learning theory (Warschauer, 1997), as well as activity theory, situated action model and distributed cognition in a project-based situation.

There are several frameworks supporting 3D printing in project-based CALL environments.

- A project-based learning (PBL) framework in language teaching is likely to include a flipped classroom model with hands-on in-class design and manufacturing processes (Sung, 2015).
- Computer-mediated communication (CMC) for collaborative writing using Google docs within a PBL framework, which promotes social interaction, computer-mediated negotiations and socio-cognitive presence in a synchronous mode (Hedayati and Foomani, 2015).

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