Scaffolding historical inquiry through a collaborative maker-based activity

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Abstract: Teaching strategies in history education could influence the development of learners' competencies. Lecture-based approaches on historical knowledge have limited potential in developing students' historical thinking and critical thinking competencies while historical inquiry has been argued to be an efficient way to develop these skills. Engaging in historical thinking development through inquiry is, however, a complex and difficult process for novice students as they will potentially face didactic and cognitive limits. We wish to contribute to the didactics of history literature in proposing scaffolds for historical inquiry through a collaborative maker-based activity combined with a knowledge building (KB) tool. Considering computer-supported collaborative learning (CSCL) literature to design collaboration, we argue that core mechanics of a sandbox videogame, 3D printing and maker culture can offer scaffolds in collaborative historical inquiry as they present congruities with cognitive operations required in historical inquiry. As interventions aiming innovations in an activity system are induced by existing contradictions, we rely on Engeström's (2001) expansive learning framework and change lab methodology that focuses on contradictions to analyze the implementation of our maker-based activity in a high school history class.

Introduction

Part of the OECD countries have initiated educational reforms aiming to develop students' 21st-century competencies in order to edify citizens that can thrive and succeed in the 21st century economy (Ananiadou & Claro, 2009). Within the 21st century competencies, critical thinking is one of the key competencies that can be developed through the study of history when students are asked to reason critically and evaluate historical interpretations or sources. While 21st century competencies are gaining importance in OECD countries' curriculums, there is also an increased focus on the importance of implementing pedagogical strategies that give students an active role in the classroom (Dede, 2010). In the context of those reforms, state like Spain, France, Australia and the province of Quebec have been marked by a debate about the possible return of monolithically transmitting nationalistic narratives of the past as the main teaching modality to solidify national identities (Létourneau, 2017; Stuurman & Grever, 2007). In that debate, two different purposes of history learning oppose each other: the development of citizens able to use history as a tool to understand themselves and the world, and the development of citizens serving a changing collective memory, a memory whose content modifies itself as the definition of the nationalistic "we" changes (Ethier&Lefrançois,2017, p.50). In the province of Quebec, that debate led, following the recommendations in the Beauchemin and Fahmy-Eid report (2014), to the creation of a new history program based on the transmission of knowledge and on the diminution of the importance of competencies. Traditional lecture-based practice is therefore still the most used pedagogical approach in history classes (Boutonnet, 2015; Molin & Grubbström, 2013; Rantala, Manninen, & van den Berg, 2016). In lecture-based approaches, monolithically transmitting historical knowledge leaves little space for developing student's social sphere interpretation competency and critical thinking competency (Boutonnet, 2015; Demers, 2011). Moreover, setting fixed historical knowledge is problematic with the concept of historical thinking (Hirst, 1974) grounded in learners' agency and ability to handle complexity (Clark & Nye, 2017). Fixed historical knowledge doesn't incite students' social and intellectual agency because questions and answers are already set by the teacher (Demers, 2017). Lecture-based history education therefore does not seem to be a coherent way to develop students' critical thinking competency, which is very important in a post-truth society (Backer et al., 2016; Strong, 2017). Implementing engaging pedagogical strategies like inquiry-based learning has been argued to be a logical way to help students develop historical thinking and critical thinking competency (Avishag Reisman, 2012; Wirkala & Kuhn, 2011). Historical thinking, or historical reasoning, is argued to be an analytical and critical posture where historical sources are breeding ground in establishing fact to answer historical or historiographical questions (Yelle & Déry, 2017). However, historical thinking development through inquiry is a process with potential obstacles and students' resistance. Historical inquiry can be cognitively demanding for novices learners. High school student resistance in admitting the relative nature of the past is also an important tension in historical thinking development (Duquette, 2011). Students also spontaneously consider history as a copy of the past that is often grounded in historical myths (Letourneau, Cousson, Daignault, & Daigle, 2015) rather than a way to understand it (Lee, 2005). Therefore, there is a need to induce conceptual change for them to accept the relative nature of history. Conceptual change can be produced through sociocognitive conflict because, as Éthier (2000) mentions, until a learner perceives flaws in his cognitive tools, he has no reason prompting him to engage in a cognitively heavy approach. Limon (2001) has stressed that teaching strategies aiming at sociocognitive conflict are requiring a higher student engagement than what traditional teaching strategies can offer. In that sense, playing, building and interacting with the world have been claimed to be valuable ways of learning (Piaget, 2012; Vygotsky, 1980). There is also a need to scaffold the historical inquiry to help students engage in a complex cognitive process as students may want to come back to listening to a narrative if they see historical inquiry as a process that is too complex for them. Technology-enhanced learning has been argued as a way that can help scaffold historical inquiry (Brush & Saye, 2008; Hicks & Doolittle, 2008; Li & Lim, 2008). Educational technologies offer affordances that can help students in adopting a more active attitude and role towards learning (Kreijns & Kirschner, 2004; Resta & Laferrière, 2007). Educational technologies has also been argued as tools that can help develop creative thinking (Romero, Hyvönen, & Barberà, 2012) as well as knowledge building (Scardamalia & Bereiter, 2003). Affordances offered by educational technologies could therefore support historical inquiry that relies on creative thinking and knowledge building. Within educational technologies, maker technologies such as 3D printing and maker movement has been argued as a movement that can help develop 21st century competency such as problem-solving, creativity and critical thinking (Martin, 2015). Considering the need for conceptual change, for scaffolds and for student engagement, we stress that maker-based activity could help students in inquiring about the past. We, therefore, argue that integrating these learning activities in history teachers' practices could help scaffold historical inquiry in order to develop students' historical thinking. The main research question is therefore: how a maker-based activity can scaffold historical inquiry in order to develop students' historical thinking. Within these learning activities, collaborative maker-based education, in which the learners engage in learning by making artefacts, could support the historical inquiry required to support students' historical thinking. As we are using expansive learning as a theoretical framework for learning, our second research question is: how is expansive learning occurring throughout the intervention?

Historical Thinking Development

With the concept of historical thinking being polysemic, the goal of this section is to propose a non-exhaustive synthesis of its main components and link them with Voet & Wever's (2017) and Wineburg's (1991) models of students' cognitive process during historical inquiries in order to understand cognitive and didactic processes during historical inquiries. According to Marrou, the "historical elaboration process is not triggered by the existence of documents, but by an original action, the posed question, that is included in the choice, delimitation and conception of the subject" (Marrou, 1954, p.245). The *Specifying* activity (Voet & Wever, 2017), which refers to question-asking and activating prior knowledge, is one of the processes driving and guiding the historical inquiry as it defines the scope of research. Furthermore, Dalongeville (2001) considers the historical question in a dialectic way and argues that the question has to trigger a sociocognitive conflict by confronting different students' or historians' hypotheses on the question to incite students engaging in historical inquiries. Historical thinking also comprises the ability to source, appraise (Voet & Wever, 2017), analyze, critique (Seixas, Morton, Colyer, & Fornazzari, 2013) and corroborate (S. S. Wineburg, 1991) pluralistic and sometimes contradictory historical sources. Also, thinking like a historian also includes establishing historical significance (Seixas et al., 2013) of events, figures or phenomena according to its capacities in revealing a historical context or in impacting today's society by constructing, interpreting, contextualizing (Voet & Wever, 2017) and making historical inferences (S. S. Wineburg, 1991). Students are also asked to understand and adopt an empathetic attitude (Endacott & Sturtz, 2015; Lee, 2005; Rantala et al., 2016) towards historical figures to prevent judgment according to contemporary values. Lee (2005) also stresses the importance to understand central historical concepts that differs from contemporary meaning. Also comprised in historical thinking is the ability to identify and understand historical causes and consequences in order to determine historical figures' agency as well as the ability to identify and understand change and continuity of realities of the past from a temporal perspective (Lee, 2005; Seixas et al., 2013). Identifying causes, consequences, continuity and change refers to *construction* (Voet & Wever, 2017) and *contextualization* (S. S. Wineburg, 1991) cognitive processes.

Historical thinking is an unnatural and complex act that is hard for novice secondary level learners (Wineburg, 2001). Its development through historical inquiries therefore does come with some student resistance and cognitive obstacles to overcome. For example, students struggle in considering historical knowledge as reasoned point of view produced by historians. They often think that historical texts, including their textbooks, is the sole truth (Gérin-Grataloup, Solonel, & Tutiaux-Guillon, 1994). Novice secondary level learners also have troubles in taking responsibility for producing an interpretation of the past by articulating contradictory historical sources because they see history as a neutral science (Gérin-Grataloup et al., 1994). They also experience difficulties in understanding that historical figures evolved in different social, political, economic and religious context than theirs. Temporal dimension is therefore neglected and historical figures are obeying motivations linked to eternal human condition (Gérin-Grataloup et al., 1994). Nokes (2011) also underlines that historical thinking development is a cognitive challenge that may cause cognitive overload. Echoing Leotiev's concept of action and operations (Leont'ev, 1974), while historians can automatically use these cognitive operations, analyzing historical sources are often a new action that requires a lot of the students cognitive efforts. Students can also have limited prior knowledge required to contextualize, have a simplistic binary vision of the world, have an incorrect representation of the work of the historian and have an obedient attitude towards knowledge in the textbook. These obstacles can limit historical thinking development (Nokes, 2011). Nokes (2011) also suggest different scaffolding techniques to overcome these constraints: explicitly teach historian cognitive processes and display them in class with graphic organizer, work on historical or historiographical controversies. Considering Nokes' (2011) scaffolding technique and knowledge building (Scardamalia & Bereiter, 2003), we argue that a collaborative maker-based historical inquiry pedagogical sequence with a sandbox videogame and 3D printing can scaffold historical thinking development. Knowledge building refers to "the creation and improvement of ideas that have a life out in the world, where they are subject to social processes of evaluation, revision, and application" (Scardamalia & Bereiter, 2003, p.2).

Creativity, History and Knowledge Building

Creativity is often considered and analyzed through individual activities that are often limited in their scope to foster students' creativity (Romero et al., 2012). Creativity is now often considered as a social process, developed by interactions between people sharing the same context (Romero et al., 2012). We define creativity uses of technology as uses, issued from an iterative and reflective process (Runco, 2014) that are collaborative, useful and original (Romero et al., 2012; Sawyer, 2011; Sternberg & Lubart, 1995) aiming to create an innovative and pertinent way of problem-solving that is accepted by a group of reference in a context-specific situation (Csikszentmihalyi, 1996; Romero et al., 2012). The creative process leads students to explore different solutions to a problem, use different sources to guide research and choose a solution considering the problem's context (Romero, 2016) and therefore to possess agency (Clark & Nye, 2017). This definition of creativity triggered by a problematic situation echoes Vygotsky's double stimulation concept where learners collectively engage in overcoming critical conflicts by using mediating cultural artefacts in order to create a solution that emancipates them from this problematic situation (Vygotsky & Rieber, 1997). Creativity and history can seem challenging when it comes to teaching history in a monolithic lecture-based way. However, when we address history as an interpretative discipline that surely need to respect scientific requirements, but that, in the end, aims to create a new historical interpretation, creativity competency then seems very important. Historical inquiry therefore resembles the creative process when it is argued that historical inquiry is the exploration of a historical question through the analysis of different historical sources (Levy, Thomas, Drago, & Rex, 2013; VanSledright, 2010; Wineburg, 2001). As previously mentioned, creating knowledge through historical inquiry is a complex activity for students, therefore stressing the importance of scaffolding with KB. KB aims at engaging students in a collaborative effort to create or improve ideas that could support students in sustained inquiry effort. Laferrière et al. (2015, p.260) cite Allaire & Lusignan (2011), who claim that five design principles must guide educators that want to engage their student in KB: authentic problem dwelled through idea complementarity, diversification of ideas through participatory discourse, student empowerment in a democratic climate, references to reliable sources in the inquiry process and shared and in-context assessment, throughout the process. We argue that KB and maker-based education can complement each other into scaffolding historical inquiry. We consider the meta-gaming concept that argues that learning with digital games can happen outside the game (Bouko & Alvarez, 2016) in designing KB in a maker-based activity using a digital game. KB is therefore considered as a meta-making space where students are learning by discussing about the challenge that represents the making of a historical society through historical inquiry. As Knowledge-Building has been mostly studied in natural sciences subject (Bereiter & Scardamalia, 2012), there are fewer studies focusing on history and knowledge-building. This is mostly due to the fact that theoretical generalization is harder in history than natural science because of the need to convey historical theory within a compelling narrative (Bereiter & Scardamalia, 2012). Knowledge-Building to scaffold historical inquiry has, however, been studied and argued as an efficient way to engage learners in explaining historical phenomena and in theory improvement (Chan & Schoo, 2016; Resendes & Chuy, 2010). While studies focusing on historical thinking development through knowledge-building has considered components of historical thinking, they have not considered procedural concept of historical inquiry as a variable to consider when proposing scaffolds. We therefore wish to contribute to this knowledge gap by customizing KF scaffolds in order for them to be aligned with historical inquiry process as well as historical thinking concepts.

Maker-Based Education

According to Voet & De Wever (2016), technology uses in history classes aim to facilitate access to information, but do not offer scaffolding of historical inquiry. Levy et al. (2013) also mention that, unlike natural science inquiry, historians cannot reenact the topic under investigation. There are several videogames that reproduce immersive 3D historical environments, like *Civilization*, *Assassin's Creed, Age of Empires* and *Rome Total War*, "that provide the opportunity to recreate historical events. Narratives embedded in historical content allow history games to offer unique affordances for reenacting, replying, and gaining first person experiences within the realms of history and social studies" (Young et al., 2012, p. 78). These commercial off-the-shelf (COTS) videogames can be motivating for students when it is pedagogically well integrated. COTS videogames can, however, sometimes carry misconceptions of the nature of history, such as offering a teleological view of history where progress unavoidably happens, as well as reinforcing dominant historical myths because of the demands on game designers to gamify (Metzger & Paxton, 2016). Moreover, adding text or historical information that is not in core gaming mechanics has been argued as insufficient to foster learning while gaming (Akkerman, Admiraal, & Huizenga, 2009; Moshirnia & Israel, 2010).

We argue that our chosen maker-based education tools, sandbox videogames and 3D printing, could alleviate these tensions by helping model and print a 3D historical environment and therefore help meet the students' need for truth when studying history (Duquette, 2009). Based on the LM-GM model (Arnab et al., 2015) and its extension LM-GM-LT (Patino, Proulx, & Romero, 2016), we reason that the chosen sandbox videogame is coherent with our idea creation intention, as their core mechanic is constructing. 3D printing is also coherent with our intention as its core mechanic, creation, meets the creation description in Cohen et al. (Cohen, Jones, Smith, & Calandra, 2016) model of makification mechanics. Moreover, the chosen sandbox game core mechanics and maker culture mechanics are building, creating, role playing, perspective taking, sharing and networking. These mechanics could therefore support historical thinking components such as contextualization, historical empathy as well as comparing and corroboration of historical accounts. KB mechanics of theory improvement while inquiry could parallelly support historical thinking and historical inquiry components such as analysis and critics of historical accounts, historical reading, establishing causation and consequences. The maker-based activity is considered as a creative activity that could trigger the need for historical inquiry. The maker-based activity combined with KB design principles could therefore incite students to work in the proximal zone of development and create a historical interpretation to answer a historical or historiographical problem. Sandbox videogames and maker-based activity could also provide the engagement needed for conceptual change as they have been previously argued to help learners reach a high level of engagement (Blikstein, 2013; Csikszentmihalyi, 1996; Kiili, de Freitas, Arnab, & Lainema, 2012). Engagement and the reach of the state of flow (Csikszentmihalyi, 1996) has also been argued to have beneficial impacts on learning (Hamari et al., 2016; Webster, Trevino, & Ryan, 1994). Taradi et al. (2005) underlines that videogames can help students in adopting a more proactive and exploratory attitude. Videogames can also help to increase students' educational agency and obtain immediate and individualized feedback in relation to the actions taken in the game (Perrotta, Featherstone, Aston, & Houghton, 2013). Gamed-based learning can also help the teacher in respecting each leaners' own learning rhythm. Engaging students in a creative process of a historical environment and historical interpretation could also support a more scientific conception of the subject of history as the game can be underlined by the teachers as another artefact that makes sense of the past. Maker education could also support historical inquiry. Games can help in promoting higher-order thinking and social skills (Dondlinger, 2007; Steinkuehler & Duncan, 2008).

Learning-by-making is a creative computing approach aimed at engaging learners in the construction of digital and tangible artefacts through the use of technology (Martin,2015). While learning-by-making and the maker movement are mostly integrated in STEAM subjects (Papavlasopoulou, Giannakos, & Jaccheri, 2017), we argue that social sciences like history could benefit from this learning approach. Through maker-based activities, participants can be engaged in constructionist activities based on developing an idea and then designing and creating an external representation of that idea (Kafai & Resnick, 1996; Papert & Harel, 1991; Sheridan et al., 2014). While learning by creating artefacts, learners can develop 21st century competencies, such as creative problem-solving (Katterfeldt, 2014). Maker activities are not focused on digital technologies but on design-based approaches of creating an artefact to provide a solution to a problem. The maker movement culture based on sharing, autonomy, iteration giving, participating and supporting (Barma, Romero, & Deslandes, 2017; Cohen et al., 2016) could facilitate the emergence of creative processes and outcomes and support the design principles of KB. Maker culture also considers errors as positive functions of progress (Martin, 2015). A research project, *Agency by Design*, led by Harvard Graduate school of education indicated that making can contribute to empowering learners and develop a greater sense of possibilities to engage and shape their future (Agency By Design, 2015). Jefferson and Anderson (2017) highlights the potential of maker activities, both in formal and informal, learning contexts to foster creativity (Posch & Fitzpatrick, 2012), but also other key competencies for the 21st century such as collaboration and problem solving.

Collaborative Uses of Technology

We favor collaborative uses of education technology such as videogames and 3D printing as they hold interesting educational added value (Romero, Laferriere, & Power, 2016). We define collaborative uses of technology by the co-construction of knowledge with a sustained mutual comprehension in order to collaboratively solve an ill-defined or authentic problem (Roschelle & Teasley, 1995; Slavin & Davis, 2006). Collaboration contrasts the cooperation concept grounded in the division of labor where each learner is responsible for a part of the work in order to solve a well-defined problem (Dillenbourg, 1999). Our vision of collaborative learning with technology echoes to the concept of computer-supported collaborative learning (CSCL) that is defined by "an environment in which a large amount of information can be easily accessed and in which knowledge is shared and co-constructed through communication and product creation" (van Drie, van Boxtel, & van der Linden, 2013, p.265). When it is well conceived and implemented, collaborative uses of technology can foster more student accomplishment in which students can acquire more factual knowledge and can develop problem-solving competency than in individual uses (Johnson & Johnson, 1989; Johnson, Johnson, & Smith, 1998; Resta & Laferrière, 2007). Students also generally show a more positive attitude towards the topic and are more motivated to learn when to collaborate with technologies (Resta & Laferrière, 2007; Springer, Stanne, & Donovan, 1999).

Collaborative leaning with technologies does not, however, automatically generate pedagogical added value. CSCL literature offers several collaborative design principles to consider when working in teams with technologies. The advantages of working in a team have to be greater than the cost of coordination and communication transaction actions (Kirschner, Kirschner, & Janssen, 2014). Moreover, digital and physical environment has to be conducive to discussion interactions (O'Donnell,1999) where the instructor has to offer student scaffolding while demonstrating leadership skills in order to foster meaning-making and meaning-negotiation (Pea, 2004) and to foster the emergence of different perspectives and points of view (Dillenbourg, Baker, Blaye, & O'Malley, 1995) for students to recognize their intersubjectivity (Koschmann, 2002). Student collaboration also has to allow mutual and sustained comprehension of the object (Arrighi & Ferrario, 2008; H. H. Clark & Wilkes-Gibbs, 1986; Roschelle, 1992) where collaboration dynamics are not based on domination or simple accumulation of ideas without negotiation between team members (Mercer, 1995). Wegerif (2006) also stresses the importance of considering ways that student can interact online when high order thinking skills are the pedagogical intention of the activity. Therefore, students must have a space to step back to actively take account of others' point of view to create a dialogic space of reflection. For example, the practice of blogging has been mentioned by Wegerif as a "participation in a process of collective reflection" that can "deepen the dialogic space of reflection" (Wegerif, 2007, p. 212) Students also need to share a mutual responsibility towards learning process and shared object of the activity (Fransen, Weinberger, & Kirschner, 2013). Collaboration cannot only be considered from a dialogical perspective but must be considered as an activity grounded in an activity system. Frameworks emphasizing triangular dynamics, like activity theory (Engeström, 2001), allow us to understand systems in which collaboration occurs. In an activity system, mediating tools (Vygotsky, 1978) and the community also participate in the structuration of collaborative inquiry processes aiming at dwelling the shared object (Sami & Kai, 2009). Collaborative knowledge creation can also help induce idea advancement and foster deep understanding (Wiske, Sick, & Wirsig, 2001). We therefore adopt an activity theory analysis framework and methodology in implementing collaborative the maker-based pedagogical sequence. We also wish to combine our maker tools, which are a sandbox videogame and 3D printing, with a Knowledge Building digital interface such as the Knowledge Forum (KF) in order to scaffold KB in historical inquiry.

Designing Collaborative Maker-Based Activities for Historical Thinking

This research project aims to complete the first four steps of expansive learning through Change Laboratory in one class of a high school situated in Levis (Quebec City, Canada): presence of need of state, analysis of the need of state, co-modeling of the tool and implementation of the tool. Change Laboratory methodology for expansive learning is rooted in the key concepts: double stimulation, conflicts of motives, practical experimentation, transformative agency, germ cell and theoretically mastered concrete development of knowledge (Sannino et al., 2016). It is important to mention that these concepts are intertwined and do not occur mechanically in the Change Laboratory methodology. It is also important to stress that expansive learning process based on transformative agency can be anticipated by the research interventionist but cannot be predicted nor controlled as learners are the one staking over the direction and scope of expansive learning process. It is, however, important to offer an anticipative design of our interventions in the chosen activity system. We are now going to offer an instructional design based on this methodology. According to Engeström et al. (1996), change Laboratory methodology's main tool is a 3x3 square surface that is in front of the participants (See Figure 1).

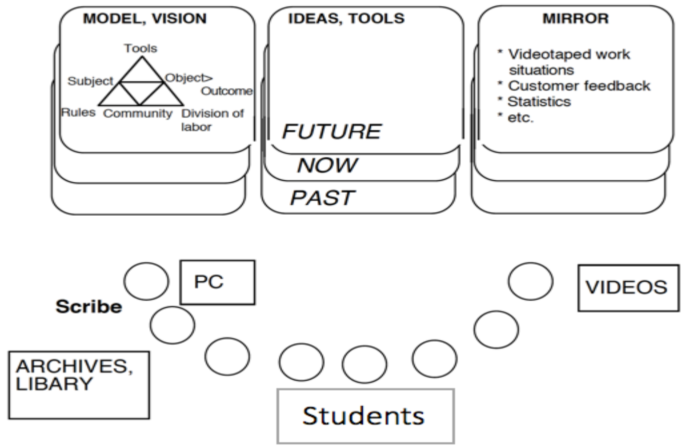

Figure 1. Prototypical layout of Change Laboratory (Engestöm et al., 1996)

The squares at the right end of Figure 1 are used to represent and analyze the activity contradictions and tensions, problematic solutions as well as the implementation of innovative solutions. To mirror problematic solution or innovative solutions, we are going to videotaped in-class episodes and present dialectical analysis of contradictions in semi-structured interviews according to Engeström & Sannino's method (2011). The interviews will be conducted before and after the tool implementation in order to identify dilemmas, conflicts, critical conflicts and double binds experienced by students and the teacher. Ethnographical observations with video recording will also be conducted before and after the implementation of the tool to analyze the activity and notably interactions with the co-constructed tool. Left end square of Figure 1 is assigned for theoretical and conceptual analysis of the activity system. The triangular model displayed in Figure 1 can be displayed to the participants in order to show them the systemic quality of the activity system as well as its inner contradictions and tensions. The middle squares are reserved for co-designed intermediate cognitive tools and ideas (Engeström et al., 1996) that aims to analyze the problematic situation and to generate innovative solutions to overcome the problematic situation. The vertical dimension of the 3x3 squares' surface is the temporal dimension representing movement between the past, the present and the future. Change Laboratory usually starts by mirroring present problems but then moves to the past to mirror historical roots of the present-day problem and past activity system. Change laboratory works then focus on representing the present activity system and its inner contradictions which aims to help participants in identifying the system's tensions and to focus their transformation efforts on identified sources of tension (Engeström et al., 1996). Participants are then more able to envision a future model of the activity and generate a partial solution to the problem and identify tools to carry their solutions and implement them in classroom practices. A model of expansive learning cycle can also be shown to the participants for them to see projected evolution of their activity (see Figure 2). It is important to note that expansive learning process does not mechanically advance from one stage to another. Each stage of expansive learning possesses its own smaller cycles. We employ expansive learning with knowledge building because, despite some epistemological differences, they share many features like the dynamics of knowledge creation, the use of mediating artefacts in knowledge creation, the consideration of knowledge creation as a social process, the recognition of individual efforts in knowledge creation and the importance of collaboratively sharing an object of activity (Paavola, Lipponen, & Hakkarainen, 2004). While KB is more oriented on conceptual artifacts and expansive learning is more focused activities and practices, we argue that combining these two approaches could offer a strong theoretical and practical framework that could support historical thinking development in formal learning settings. Moreover, this study also wishes to analyze to correlation between expansive learning steps with the number and type of student interventions in the knowledge forum.

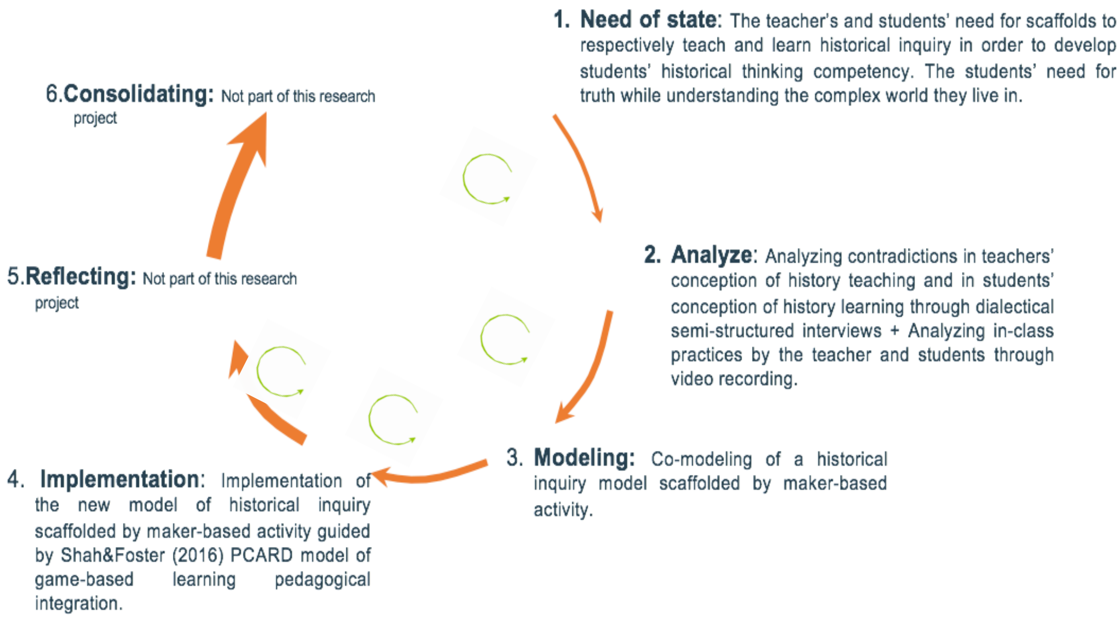

Figure 2. Anticipated expansive learning cycle

Implementation of the tool in class will be guided by a modified version of Shah & Foster's (2016) Play Curricular Activity, Reflection and Discussion (PCARD) and Inquiry, Communication, Construction and Expression model (ICCE). These two intertwined models aim to facilitate inquiry-based learning and game-based learning in the classroom. In the ICCE model, *inquiry* is seen as a problem-solving activity within the game environment (Foster & Shah, 2012) while *communication* is considered as meaningful interactions on the shared curricular object that multiple levels like game-student, student-peers and student-teacher. *Construction* of knowledge is regarded as gaining knowledge through gameplay, communications focusing on game experience as well as construction of artefacts to represent or demonstrate understanding in gameplay. *Expression* includes opportunities to share ideas, feeling, values related to gameplay and learning experience with games. Considering the constructing core mechanics of the chosen sandbox games, we wish to modify the structure of the PCARD-ICCE model. *Play* and *reflection* components are therefore going to be switched for *reflection* component in PCARD corresponds to *inquiry* in ICCE and for *play* to correspond with *constructing* component (see Figure 3). We anticipate that showing this pedagogical integration model will contribute to the efficient implementation of the tool.

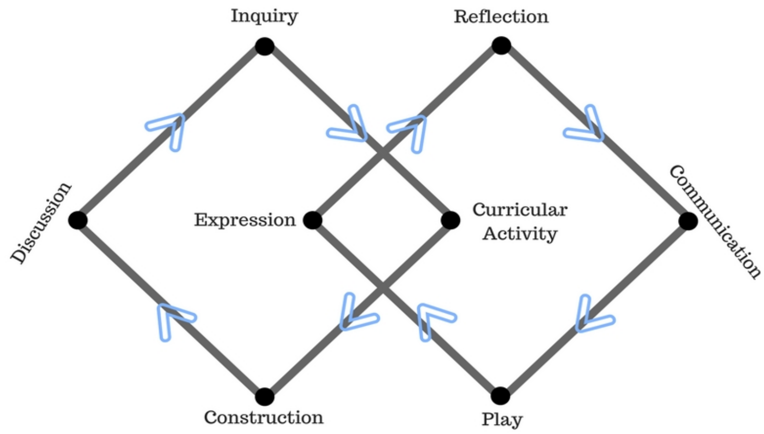

Figure 3. Pedagogical integration of the tool

Assessing Historical Thinking Development, and Expansive Learning

Construction of the tool for assessing historical thinking development will be co-designed with the participating teacher. In building our assessment tool, we will consider Reisman's work (2015) that underlies some tensions in assessing historical thinking competency that is partially dependent on the learners' reading competency. According to her, historical assessments must avoid in evaluating skills that are parallel to historical thinking like written style or fluidity. It is also problematic to determine the exact value between historical thinking processes and historical knowledge in an evaluation. Thirdly, logistical constraints such as the lack of teachers' time and high number of students are also obstacles in assessing historical thinking through written dissertations. To address these issues, we will use VanSledright (2013) model of assessment of historical thinking based on multiple-choice questions to assess historical thinking. The assessment is going to be carried at the end of the maker-based activity where student will participate in a student symposium where they are going to be asked to present their 3D printed historical environment as well as to present a historical interpretation of the constructed society. We will also assess historical thinking development through a written argumentation of a historiographical or historical question. Assessment will be guided by Smith & Breakstone's (2015) three operational component of historical thinking: a) students have to be able to recall memorized historical facts, situate them through time and space, establish their historical significance and as well as establish links amongst these facts; b) assessment of historical proofs through critical analysis of historical sources in order to corroborate them and to source them; c) use historical proofs in order to construct historical knowledge and propose a historical interpretation through argumentation. Expansive learning process assessment will be based on Haapasaari, Engeström, & Kerosuo's (2014) methodology for tracing transformative agency. We expect that, despite some resistance and tensions at first from students, our maker-based activity is going to offer students scaffolding in their historical inquiry and help them develop their historical thinking competency. The effectiveness of the maker-based activity will be assessed through a questionnaire adapted from Fu, Su, and Yu, (2009) and from Koole, Dionne, McCoy and Epp, (2017).

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