Design fiction as a critical inquiry method in media education: first findings of an exploratory research project

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Abstract

This paper suggests a new application of design fiction in media education to engage pupils in critical reflection and evaluation of digital media and technologies. Design fiction refers to a design practice that uses narrative structures to explore possible futures for technologies and questions people about the impact of new technologies on everyday life. The purpose of design fiction is to materialize possible scenarios by creating diegetic prototypes and then debate them. Diegetic prototypes refer to objects and services that only exist in a story world, the world of the diegesis.

As a result of recent technological changes, media education is looking for new methods for understanding the media environment. In this context, design fiction offers a new way to re-think our relationship with technologies through the production of diegetic prototypes. I propose considering design fiction as a critical inquiry method which enables pupils to ask relevant questions about digital media and technology with the objective of developing their critical thinking.

Based on the findings of a scientific observation of two pilot projects in primary and secondary schools, this paper presents a preliminary version of a critical inquiry method using design fiction at school as well as a method to assess pupils' critical inquiry competence. The critical inquiry method takes the form of an educational program divided into several sessions in which pupils are invited, among other things, to create a diegetic prototype, contextualise it in a near future and discuss the consequences of its implementation in the imagined future society.

Introduction

Media education has never been more important than it is today. The need to develop

critical thinking is regarded as vital in the digital age where technology is omnipresent and part of our everyday lives. As Buckingham (2007) explains, "[i]n the context of media education, the aim is not primarily to develop technical skills, or to promote 'self-expression', but to encourage a more systematic understanding of how the media operate, and hence to promote more reflective ways of using them" (49). Rather than pointing out knowledge or skills needed to understand and produce media, I propose thinking about the kind of questioning that media literacy can develop in a media education context and using, for this purpose, design fiction.

Design fiction is a method that uses narrative structures to consider and explain possible futures for technologies. The term was first coined by Bleecker in 2009 to refer to the process of exploring possible near futures in science and cinema. At the intersection between science fiction and science fact, design fiction is defined as "the embodiment of materialized reflections on design today, as well as projections and anticipations of the designed futures" (Bleecker, 2009: 17). A key feature of design fiction is the consideration of the technical aspects of an invention in relationship with its social, cultural, ethical, political, and economic implications on the imagined society (Tanenbaum, 2014). Demonstrating a critical concern for society, design fiction questions people on their everyday use of technology through the exploration of possible near futures (Mitrovic et al., 2015).

In the framework of my doctoral research, I propose using design fiction in media education to engage pupils in a critical reflection and evaluation of digital media and technologies. One major feature of design fiction is to question and critically think about our use of technology. This feature is in line with the purpose of media education, which encourages critical views on digital media. Based on Dewey's theory of inquiry (1938), I suggest considering design fiction as a critical inquiry method in media education. A critical inquiry method is a method which enables pupils to ask relevant questions about digital media and technology with the objective of developing their critical thinking (Kellner & Share, 2005). The concept of inquiry refers to a type of systematic questioning that underlies the educational process, where citizens adopt a scientific attitude towards everything as opposed to a non-critical attitude (Cospérec, 2018).

This paper presents the exploratory research phase and its first results. I set up a design-based research project that began in September 2018 in collaboration with a Belgian non-profit association called Action Médias Jeunes. The association conducted a project called 'HACK to the future'[1] that used design fiction in primary and secondary education, in which I was involved as a scientific advisor and observer. Based on the findings of the classroom observations, I propose a preliminary version of a critical inquiry method using design fiction in media education as well as a method to assess pupils' critical inquiry competence. I demonstrate how the educational program draws from design fiction and uses it to foster

critical inquiry about digital media and technologies.

The paper is divided into four main sections. First, I review the scientific literature on design fiction, media literacy and inquiry-based learning to investigate the use of design fiction in media education. I also suggest reflecting on what makes critical design and critical media literacy 'critical' to distinguish critical from non-critical questioning. Second, I describe the research methodology, design-based research's context and phases. Third, I explain in detail the steps of the critical inquiry method and the associated classroom activities. Fourth, I present the method for assessing critical inquiry.

1. Literature Review
1.1. Design Fiction: Between Prototyping and Storytelling

Science-fiction author Bruce Sterling defined design fiction as "the deliberate use of diegetic prototypes to suspend disbelief about change" (Bosch & Fritcke, 2012). Diegetic prototypes are objects and services that only exist in a story world, the world of the diegesis. Diegesis is a term borrowed from film scholars and narratologists, which refers to everything that is part of the story world. For instance, a piece of music in a film is diegetic if characters can hear it. Similarly, diegetic prototypes only belong to the fictional world: they are part of the narration and do not exist in the real world. A common example of diegetic prototype is the gesture-based computer-interface in *Minority Report* (2001).

Diegetic prototypes are at the intersection of two activities: prototyping and storytelling. On the one hand, prototyping is "an incredibly powerful tool, allowing designers and design teams to understand how the product of their divergent, creative, or 'designerly' ways of knowing (Cross, 2008) might manifest themselves in a finished product" (Lindley et al., 2014: 241). In other words, prototyping allows designers to 'play' with ideas before concretising them. This phase is part of a larger process, called design thinking. Design thinking refers to a set of user-centred practices and methods within social and business innovation contexts. Plattner et al. (2011) describe five phases in design innovation process:

1. Empathy: understanding users' wants and needs
2. Inspiration: defining the problem and benchmarking
3. Ideation: generating ideas (brainstorming)
4. Prototyping: turning ideas into something concrete
5. Testing: refining ideas by gathering feedback

Although design thinking is a method borrowed from traditional design, design fiction is mainly used in critical design. The purpose of design fiction is not so much to solve a problem by creating an object or service, but rather to materialize possible scenarios by creating fictional artefacts and then debate them. Moreover, the design thinking 'testing phase' is not part of the

design fiction process, as diegetic prototypes remain fictional.

On the other hand, design fiction is a form of storytelling: it tells a story about a prototyped object in an imagined world. As defined by Mitrovic et al. (2015), design fiction uses narrative structures to explore possible futures for technologies and questions people on the role and impact of new technologies on everyday life. Design fiction generates what Bleecker (2009) called 'conversation pieces' which mean "stories that speculate about new, different, distinctive social practices that assemble around and through these objects" (8). Diegetic prototypes tell a story about people and their mundane social practices in a possible near future. Stories offer a richer way of materialising ideas and sharing them with a large audience.

As mentioned above, design fiction can be used in traditional design to explore new ideas for creating products and services. Companies collaborate with scientists to design prototypes that are then presented to consumers. For instance, an international team collaborated with IKEA to envision alternative futures of the industry "…that highlighted the sorts of tensions that we thought were interesting to investigate, as well as productive in terms of design" (Brown et al., 2016: 2). They created a catalogue, as an example of a design fiction, to think and talk about future technologies, such as drones or virtual reality glasses.

For several years, new approaches to design have emerged and questioned the boundaries of the traditional disciplines in design such as radical design, interrogative design, discursive design, future design or transitional design. Critical design includes these new approaches and aims to critically reflect "…on the development and the role of the technology in everyday life, without dealing with the applications of technology, but rather considering its implications" (Mitrovic et al., 2015: 11). Design is used here as a medium to question the practice of design itself and to discuss broader political, social and cultural issues. Unlike traditional design, the goal is not to resolve problems and provide answers but rather to find problems and ask questions. This form of design is separated from the marketplace and aims to make people think how the world could be by generating an alternative to how things are now.

Critical design uses design fiction to create fictional products, services and systems from alternative futures to critically engage people with them as consumer-citizens (Dunne & Raby, 2013: 49). Therefore, critical design does not focus on designers or contractors' interests, but rather widens participation in the debate on future technologies to the users themselves. For example, the Atelier Van Leshout (AVL) explores with their project 'SlaveCity-Cradle to Cradle' (2005-) "what size city could be supported if we used humans as slaves to produce energy and even as a source of energy of themselves or as raw material" (86-87). This example is inspired by science fiction to conceive a prototype machinery, among other things, that questions how the city would work economically and its optimal scale. The project is part of what Dunne and Raby call 'functional fictions', namely fictions that are used for a specific purpose: asking

questions.

1.2. Approaching Media Education with Critical Media Literacy

Media education refers to "the set of teachings, pedagogical processes and activities that contribute to the development of critical thinking and media literacy" (Landry and Basque, 2015: 59; author's translation). Media literacy generally refers to the knowledge and skills needed to analyse, evaluate, or produce media messages (Martens, 2010). Many definitions of media literacy can be found in the scientific literature but only one reaches the consensus, the definition from UK media regulator Ofcom (2004), defining media literacy as "the ability to access, understand and create communications in a variety of contexts".

Media education focuses on a wide range of issues in today's society, such as consumer awareness of the power structures that shape media representations (Kellner & Share, 2007b) or the emergence of a participatory culture (Jenkins, 2009). Concerned with an active citizenship participation, media education aims to develop critical thinking and democratise society. Kellner and Share (2007a) list four major approaches to media education: the traditionalist 'protectionist' approach (protection against the harmful effects of media); a 'media literacy' movement (analysis of media texts); media arts education (self-expression through creating art and media); and critical media literacy. Kellner and Share (2007a) explain that critical media literacy expands the notion of literacy "to include different forms of media culture, information and communication technologies and new media, as well as deepen the potential of literacy education to critically analyze relationships between media and audiences, information and power" (4). In this approach, media literacy plays a resistance role to an unfair social order and aims at developing skills that will enhance democratisation and participation. Critical media literacy aims to empower people by enabling them to create their own meanings and identities; this is a means of collective emancipation.

One way to develop critical media literacy, and more broadly to teach media education, is to engage students in media production (Buckingham, 2007). Media production contributes to the development of both technical and analytical skills: on the one hand, it is an opportunity for students to learn how to handle the tools; on the other hand, it allows them to learn how to understand, analyse and deconstruct messages by learning how to produce them. The first approach results in a reproductive posture, where students learn the codes and formats of mass media production and then use them in their own production. The second one enables students to exercise their critical thinking on the functioning of the media system as a whole.

1.3. Engaging Students in an Inquiry Process with the Help of Key Questions

In 1938, the philosopher John Dewey published his major work *Logic: The Theory of Inquiry.*

Inquiry is defined as a type of process, open and iterative in nature, rooted in experience of problematic situations that every individual and/or community faces every day. Modelled on the scientific method, the inquiry process is not specifically intended to solve problems but is first and foremost about outlining the problem's dimensions to overcome an indeterminate situation. As underlined by Scott and Friesen (2013), "Dewey encouraged students to formulate problems related to their own experiences and augment their emerging understandings with their personal knowledge" (7). Dewey advocates for a student-centred approach where students are actively involved in the learning process and where the teachers' role is to guide them in this process.

While inquiry refers to the process of asking questions in order to acquire knowledge, inquiry-based learning is the pedagogical approach using inquiry to investigate particular subject matter. Kuhn et al. (2000) define inquiry-based learning as "an educational activity in which students individually or collectively investigate a set of phenomena - virtual or real - and draw conclusions about it" (496-497). Inquiry-based learning proposes an educational strategy similar to scientific methods and practices where students are invited to formulate hypotheses and test them through experiments and/or observations (Keselman, 2003; Pedaste et al., 2015). Inquiry-based learning is a student-centred approach to learning and encourages students to formulate their own questions in order to construct the meaning of their work (Nesbit & Qing, 2014).

A number of researchers argue that the principle of inquiry is at the heart of media literacy (Thoman et al., 2008). To engage students in the inquiry process, they have built inquiry-based learning models with both fixed and flexible sets of questions (Schilder, 2014). For example, the National Association for Media Literacy Education (NAMLE, 2014) has constructed a list of key questions to analyse media messages, divided into three categories: authors and audiences, messages and meaning, representations and reality. The Center for Media Literacy (CML) has established five key questions to deconstruct the media messages. They associated them with five key words (authorship, format, audience, content and purpose), five core concepts and another set of five key questions to ask oneself in a construction process (Thoman et al.: 2008). Key questions are intended to guide students in their inquiry process when confronted with media. Besides helping them structure their questioning, the goal of this approach is to promote questioning habits beyond media education activities.

While critical inquiry seems to be an essential competence to improve students' critical thinking, the literature suffers from a lack of structured procedures for assessing critical thinking. To address this gap, Schilder and Redmond (2019) propose a method of assessing media literacy development by examining students' ability to ask their own questions. "To measure students' media literacy inquiry, we evaluated the questions they posed in response

to viewing an advertisement. We analyzed questions by media literacy concept and by level of complexity before and after their participation in the media literacy courses" (95). Schilder and Redmond (2019) argue in their study that media literacy goes beyond a set competencies and is "an active, dynamic process of complex thinking grounded in critical inquiry" (111).

1.4. Design Fiction in Media Education: Developing Critical Inquiry

Thinking about media literacy along with inquiry allows us to get back to the roots of media education, that is, observing the world around us and questioning its workings while taking into account our own position into it. Using design fiction as a critical inquiry method could help develop a broader critical understanding which addresses the textual characteristics of media alongside their social and ethical issues, and raise a personal awareness of one's own media practices. The ultimate goal is still to equip students with media literacy abilities but with another conception of media literacy:

> Consider, for example, how teachers might respond if, rather than describing media literacy with a definition about accessing, analyzing, understanding and producing media, we said "media literacy education is about teaching students to ask - and find answers - to important questions". This phrasing puts teaching and students, rather than media, at the center of the discourse. (Rogow, 2011: 17)

In the context of media education, design fiction could therefore be used primarily as an object of study. As any other media messages, design fiction texts ('texts' in the semiotic sense) can be deconstructed using key questions to highlight the way that media represent technology and our interaction with it. In a similar way to Redmond et al. (2016), having students analyse design fiction texts by identifying the questions related to the visions they convey could help in developing media literacy inquiry abilities.

Design fiction, as a design practice, can offer a second way to practice media education by using diegetic prototypes as a starting point, rather than media texts. Few critical media literacy approaches focus on media production practice to develop critical thinking. Having students design media technology prototypes could help them ask critical questions about largescale social and political issues. In the context of media education, design fiction could therefore be used secondly as a reflexive method, namely a method that makes it possible to question the role of media and technology in society from practice itself.

The purpose of these two approaches (DF as an object of study and DF as a reflexive method) is not to discuss the advent of some future, but to use such a discussion as a vehicle to develop critical thinking. I consider both approaches in my doctoral research.

1.5. What Makes Critical Design and Critical Media Literacy 'Critical'?

Bardzell and Bardzell (2013) explore 150 years of critical ideas and their practical uses in order to propose that these ideas and uses can be leveraged as practical resources for Human Computer Interaction researchers interested in critical design. They trace the origins of critical design back to the Frankfurt School of critical theory. As Kellner (2003) explains, "[t]he Frankfurt School's concern with consciousness, ideology, culture, and socialization highlights the importance of transforming individuals and societies through change of consciousness, culture, and the institutions of everyday life such as education" (65). To rethink the notion of 'critical', they also referred to metacriticism, a family of thought which is concerned with "skilled appreciation of the arts and can be found in the English-language tradition of literary criticism (e.g., Arnold, Frye, Eliot, Abrams, and Bloom) and analytic aesthetics (e.g., Beardsley, Cavell, and Carroll)" (Bardzell & Bardzell, 2013: 3300).

Bardzell and Bardzell (2013) understand Dunne and Raby's critical design as a "research strategy dedicated to transgressing and undermining social conformity, passivity, and similar values of capitalist ideology, in hopes of bringing about social emancipation" (3298). They see in critical design a strategy to cultivate in the public a critical sensibility, which is defined by Dunne and Raby as follows:

> The critical sensibility, at its most basic, is simply about not taking things for granted, to question and look beneath the surface. This is not new and is common in other fields; what is new is trying to use design as a tool for doing this. (Dunne and Raby, 2009)

Bardzell and Bardzell (2013) question this definition and point out a series of features that explain what makes critical design 'critical' based on critical theory and metacriticism. They first highlight in these two families of thought a perspective-changing holistic account of a given phenomenon which means an understanding of critical activity as "a construction of an account that holistically explains all the features of a phenomenon in a way that shifts one's perspective or improve one's perceptual acuity" (3303). Second, for both critical theory and metacritism, theory does not pretend to hold the truth but rather challenges the reader to reflect on their topic in a new mode. Third, they both "seek meaning and discovery in the struggle, heterogeneity and polyphony of human expressions and experience" (3303). Fourth, both models want to improve public's cultural competence, which refers to the ability of 'looking beyond the surface' in critical design, that is, reading sceptically, being suspicious as well as perceiving and reading with unparalleled sensitivity and insight. Finally, they both see critical thinking in service of social change.

Critical media literacy shares a common conceptual grounding with critical design. They both have roots in the Frankfurt School of critical theory. Some features that explain what makes critical design 'critical' are therefore similar to those of critical media literacy. For example, critical media literacy also aims 'to shift one's perspective' from a strictly functional understanding of the media to a broader understanding of issues in today's society. Moreover, critical media literacy helps students question current media system, express their own voices and struggle to create a better society (Kellner & Share, 2005). These objectives are in line with the goals of media education, which wants to give students "the critical knowledge and the analytical tools that we believe will empower them, and thereby enable them to function as autonomous, rational social agents" (Buckingham, 2003: 313).

An important area of theoretical work for critical media literacy comes from other fields including cultural and feminist studies. These approaches address equity and social justice issues related to media misrepresentations and stereotyping, e.g. the inclusion of some groups and exclusion of others, the dominant and positively represented groups and disadvantage marginalized and subordinate ones, and so on (Kellner & Share, 2007). They offer methodologies that help students deconstruct the representations of class, gender and race in media and reveal the structures of power and the functioning of ideology. They are both opposed to the notion that audiences are powerless and value an active role of the audience in deconstructing as well as creating media messages.

2. Methodology: Design-Based Research

In order to investigate the use of design fiction as a critical inquiry method in media education, I adopt a design-based research approach, namely a practical research methodology that implies the collaboration among researchers and practitioners in each step of designing educational interventions (artefacts, techno-pedagogical devices, or educational programs) (Jacobsen, 2014). This methodology attempts to improve educational practices through iterative cycles of design, enactment, data collection, analysis, and redesign that help refining the educational intervention (McKenney and Reeves: 2012). Barab and Squire (2004) state that design-based research interventions are conceived not just to meet local needs, but "to generate and advance a particular set of theoretical constructs that transcends the environmental particulars of the contexts in which they were generated, selected, or refined" (5). In the framework of my research, design-based research is used to create a critical inquiry method in partnership with teachers and media educators.

As mentioned above, my design-based research project began with an exploratory phase in collaboration with the non-profit association Action Médias Jeunes. Each year, the association conducts several projects for young people with the objective of developing their critical

thinking skills in a creative way. Action Médias Jeunes set up a project called 'HACK to the future' that uses design fiction in primary and secondary education. This project was conducted with another non-profit association, the Scientothèque ASBL, and was funded by the French Community Commission of Belgium (Cocof) which promotes partnerships between French cultural organisations and schools. The project consisted in imagining and designing fictional technological objects from a near future (year 2030). Two Belgian schools were involved in the project with a total of five classes: two classes of third-grade primary and three classes of fifth and sixth-grade secondary pupils. During the project sessions, pupils from both schools were invited to create their own prototype and to stage it through a media production (report, advertisement, etc.). Objects and media were then exhibited and discussed during a conference between schools and an expert to address digital world issues.

'HACK to the future' constitutes the first phase of my design-based research project. This phase aims to collect exploratory data on how design fiction can be taught and applied at school in a media education context and serves as a basis for the second phase. The project started in October 2018 and lasted a whole school year. I attended the sessions as an observer in the two primary school classes and in the sixth-grade secondary class. I was invited to take part in this project, but I did not contribute to its design. Since I did not have control over the project, I only took some field notes in a notebook without systematic recording.

For the first project sessions, I always introduced myself to pupils by explaining who I was (a researcher working for the university) and why I was taking notes (observing the sessions for my own research). I was usually sitting at the back of the class, taking field notes in a notebook, and the pupils did not pay attention to what I was doing. I was sometimes invited to take part in the session, particularly during the prototyping and shooting phases that required more guidance. After each session, I participated in the debriefing session with the facilitators and teachers: we were discussing the activity of the day and the ones to come. Finally, I attended the conference day during which I took part in discussions between fifth and sixth graders.

The second phase refines the project and meets my scientific goals, which are to design a critical inquiry method using design fiction in media education and a method for assessing students' critical inquiry competence. Unlike the first phase in which I had limited control over the activities, I develop each step of the second phase in collaboration with Action Médias Jeunes media educators. Based on the findings of the first phase, I present in the next sections a preliminary version of the methods I want to develop in the framework of my doctoral research. These methods will be discussed further with practitioners when we will begin Phase 2 sessions (September 2020). Although I attended sessions in primary and secondary education, I only consider the findings with secondary school students because the second phase renews our collaboration only with the secondary school.

Before moving on to the next point, I would like to set the context for secondary school students' observations from Phase 1. For fifth graders, project sessions took place as part of the social sciences course. Activities were related to AI technology development and concerned issues related to 'labour' such as workplace wellness, automation hiring and unemployment. Based on the problems identified in modern society, students developed fictional artefacts imagining the evolution of the world of labour in 2030. For sixth graders, sessions took place as part of their 'implementation' week, a week during school year in which students are invited to participate in various projects. Activities were related to the artistic field (a constraint of the school) and students developed fictional artefacts questioning our future relationship with art in 2030.

3. The Critical Inquiry Method

As a reminder, I define the critical inquiry method as a method which enables pupils to ask relevant questions about digital media and technology with the objective of developing their critical thinking. In this section, I propose a first version of the educational program that considers the two approaches previously specified (see "1.4."). On the one hand, the objective is to encourage students to deconstruct design fiction as any other media by analysing the vision it conveys. On the other hand, the objective is to encourage students to position themselves in today's media world and identify the current societal issues related to new technologies, based on their media technology prototype. The issues raised by the students will naturally depend on the course in which the activities will take place, the teachers' requirements and the prototypes created by the students. The literature review of what is considered critical (see "1.5.") will help assess the kind of questioning raised by students and test the hypothesis that design fiction can be used as a critical inquiry method in the context of media education. The assessment method will further address this point (see "4.").

The next pages present the main steps of the method: an introduction to new technologies, the prototyping of some media technology, the creation of a fictional world and a retrospective look at the concerns of today's society. For each step, I first introduce the general principle of the activities. Second, I present Phase 1 observations and the conclusions I draw from it. Finally, I describe Phase 2 global activity and objectives related to the development of the students' critical inquiry. I distinguish between the objectives related to design fiction as an object of study and the objectives related to design fiction as a reflexive method. The method is not linear and the steps can be mixed or repeated at different times during the program.

3.1. Introducing New Technologies

The first step will introduce students to new technologies in a way quite similar to 'HACK to the Future'. The latter proposed a set of participative activities related to artificial intelligence and

its development in art. For example, one activity consisted in visioning a fictional video about Lady Gaga who would have used an AI to produce a whole music album. Facilitators asked students their opinion and started a debate. While some students found this use interesting to innovate music or saving the career of a star, others were concerned about the question of emotions; according to them, emotions are part of what defines art and AI cannot feel anything (at least for the time being). This activity aimed at understanding the objective of the design fiction project which was to create objects that asked these kinds of questions.

Considering the concerns of today's society, activities in the second phase will still be related to AI and algorithms. The key objective of this first step is to gain knowledge about emergent technologies and understand their role in everyday life. Activities from Phase 1 mainly focused on the issues raised by design fiction and did not address design fiction as an object of study, that is, as a media that could be open to interpretation. Phase 2 will aim to fill this gap and address both approaches from the very first step through a pre-test that will assess students' critical inquiry competence.

Pre-test will consist of two activities. The first activity will encourage teenagers to ask key questions about media representations (DF as an object of study). In practice, students will search and compare short video clips on the internet that stage the use of AI technology. In a similar way to Redmond et al.'s study on media literacy habits of inquiry (2016), participants will have to think about "questions that could be used in order to engage the audience in deeper, critical thinking and analysis about the media" (59). The second activity will encourage teenagers to question their current uses of algorithm-based technology in terms of consumer consumption (DF as a reflexive method). In practice, the activity will extend and deepen the first one and will focus on the issues raised by algorithm-based technology. Along with critical discussion, debate, and analysis, the goal will be to guide students "in an inquiry process that deepens their critical exploration of issues that affect them and society" (Kellner & Share, 2005: 373).

3.2. Imagining Future Media Technology – "Designing How Things Could Be"

The second step consists in imagining future media technology prototypes through a design thinking process (see "1.1."). Phase 1 started this process with an inspiration phase during which students were invited to share stories about problems they had already encountered in the world of art. For example, a pupil talked about the problem of museums that are huge and cannot be fully visited, while another pointed out the lack of context and information about the artists during visits. After dividing the class into three groups, each group started to think about the problem they wanted to solve and the object they wanted to create.

Steps 2 and 3 were reversed in Phase 1, so that sixth graders considered the context of

their invention in the prototyping phase. This approach allowed them to distance themselves from an individualistic view of technology they had at the beginning of the design thinking process. Although this has resulted in adopting a collective perspective addressing large-scale social issues, students still had a solutionist perspective whose goal was to solve a problem. The second step of Phase 2 is not intended to produce a prototype that solves a problem but rather to give free rein to the students' imagination and then see how their prototypes can cause problems. Step 2 therefore does not include an inspiration phase and focuses on the ideation and prototyping phases.

The first activity will be to share ideas about the piece of media technology students want to create. They will describe its technical characteristics and its different uses in a notebook. The second activity will propose illustrating the use of the prototype. To this end, teenagers realised media production in the first phase. Two of the groups in sixth grade created commercial videos that staged a presenter and potential users. I propose for the second phase that students explain how their prototype works by creating user scenarios, a method from UX design. The form of the scenarios will be adapted (video prototyping, scripts, comics, etc.) depending on the available equipment and the students' desires.

> A user scenario is the fictitious story of a user's accomplishing an action or goal via a product. It focuses on a user's motivations, and documents the process by which the user might use a design. User scenarios help designers understand what motivates users when they interact with a design – a useful consideration for ideation and usability testing. (Interaction Design Foundation, n.d.)

With user scenarios, I suggest not staying stuck in an affirmative design that wants to sell a product, but to distance oneself from what we can create, and to think about technology's problems. Although user scenario writing is a method incorporated into traditional design and is focused on individual uses, students will already engage in an inquiry process where they will ask themselves a series of questions about the prototype they are developing. Who is the user of the object? What does it accomplish for the user? What risks and contingencies can be expected? The second step will focus on media technology prototypes and will aim to discuss the potential problems that other students' objects can cause (DF as reflexive method).

3.3. Imagining The World Of 2030 – "What Would Happen If…?"
The third step consists in imagining the world of 2030 and the consequences of the implementation of students' prototypes in this world. During the first phase of the project,

facilitators asked students, on my recommendation, to write a scenario to implement their invention in the future world. Each group first worked on its own scenario and then negotiated with others to create a common script. They covered all topics in their scenario: health sector, sciences, politics, ecology and culture. Moreover, they drew inspiration from actual events to consider the future world, particularly global warming which seemed to affect them a lot. This activity allowed us to collect a large amount of data on the representations they have of the future.

Students will again create a common script in Phase 2. I decided to keep the year 2030 because many things can come up in ten years and it is easier for students to imagine a very near future. Students will be invited to think about the implications that their invention would have on imagined society. 'The tarot cards of tech'[2] is an example of a tool for considering the impact of technology. Cards ask questions such as: 'What is the worst headline about your product you could imagine?' 'What happens when 100 million people use your product?' 'When you picture your user base, who is excluded?' and so on. The challenge will be to go beyond the dominant technological horizons and encourage students to think about change and consider alternatives (DF as a reflexive method). The card game will be used at the beginning to frame the activity, but the objective is that the questions will then come from the students themselves.

3.4. Going Back to the Present Time

As Dourish and Bell (2014) point out, "… any imagination of a possible future is grounded in expectations, frustrations, and understandings of the present" (778). In order to close the loop, the last step will link imagined society, future media technology prototypes and user scenarios created by students to address concerns of today's society. Phase 1 proposed this kind of activity during the conference day where teenagers were invited to discuss the objects from other groups. I attended some discussions and, based on my observations and field notes, I noticed that students often questioned their point of view. They realised that it was not easy to create a piece of technology that suited everyone and that many issues arose during the development of a new object. Discussions seemed to evolve from monologic to critical dialogic conversations, that is, from brief and independent answers not spontaneously justified, to more open-minded and justified statements that take others' perspectives into account (Daniel, 2007). Based on this observation and my literature review (see "1.5."), I can confirm that students adopted a more critical view at the end of the project.

An example of discussion was about the technological device 'Application for Job' that consists in deleting all discriminating elements on a CV (such as religion, origins, picture etc.) The person is thus hired only based on their actual skills. To start the debate, the facilitator

asked students if they found it was a good idea to implement this application. At the beginning of the discussion, they all agreed on its positive impact in the hiring process. However, students pointed out that there were other steps in the hiring process (like the interview) and that it was difficult to select which elements were the most discriminating. The facilitator continued the conversation by mentioning the implicit bias of algorithms in repeating discrimination; the problem with creating a technological device like 'Application for Job' is that the algorithm is based on current society where there is already discrimination. Rather than agreeing on a single answer, students discussed the different issues raised by this piece of technology and proceeded the same way with the other objects, balancing the pros and cons of each one.

Although the focus was on problem solving all along the Phase 1 design thinking process, teenagers overcame a solutionist perspective at the end of the project. They realised that problems generate other problems and a single solution cannot exist. They progressed from a problem-solving attitude to a problem-presenting attitude which is representative of the purposes of design fiction (Mitrovic et al., 2015). The second phase will still aim to encourage students to adopt a critical attitude. In order to observe the evolution of the students' critical thinking, Step 4 will include a post-test similar to Step 1 pre-test (see "3.1.") Rather than searching for videos on the internet, students will analyse user scenarios of others. Activities will encourage students to question the way user scenarios represent the piece of technology imagined (DF as an object of study) and the prototype as such (DF as a reflexive method). Moreover, the fourth step of Phase 1 was still too anchored in speculation and Phase 2 will try to improve the connection between students' interrogations and their current practices and current technological issues.

4. The Assessment Method

The assessment method aims to observe and analyse the evolution of students' critical inquiry competence throughout the educational program. The method assesses students' ability to question critically both media technology (DF as a reflexive method) and media texts (DF as an object of study).

4.1. Data Collection

To assess students' critical inquiry competence, I will conduct a pre-test and a post-test (see "3.1." and "3.4.") using a Solomon Four Group Design. In addition to the basic pre-test/treatment/post-test design, the Solomon Four Group test does three additional tests which allows the subjects to overcome the problem of pre-test sensitisation. As Navarro and Siegel (2018) explain, its central feature "is that participants are randomly assigned to either receive or not to receive a pretest and then randomly assigned to either a treatment or a comparison

group. All participants then receive a posttest". As a result, the four groups have four different experiences:

	Pre-test	Treatment	Post-test
Group 1	x	x	x
Group 2 (control)	x		x
Group 3		x	x
Group 4 (control)			x

In the framework of my research, I will design a similar test except that students will not be randomly assigned to the groups. Two classes will be each divided into two groups. While the first class will participate in the educational program, the second class will include the control groups. Each class will consist of two groups: one that will receive the pre-test and the other that will not. The control groups will not have produced fictional prototypes because they will not have participated in the educational program and will therefore analyse the user scenarios of the students from the other class for the post-test.

Other data will be collected all along the educational program and will contribute to assess critical inquiry competence. As in Phase 1, I will attend the sessions and take field notes in a notebook. This notebook will describe both the course and preparation of the classroom activities and subjective observations on the phenomenon studied. I will also collect the students' creations and teaching materials that will be indexed in a numerical database.

4.2. Data analysis

To analyse students' questions, I will look at the content areas about which students ask questions and the complexity of the questions within each of these areas (Redmond et al., 2016). To examine students' questions by type, I will build an analytical grid based on inquiry-based learning models used in media education. I propose below a first version of the analytical grid incorporating Funk, Share and Kellner (2016)'s CML six concepts/questions in the first two columns. Actual key questions models only analyse media as 'texts', so that I include an additional column to analyse students' questions about media technology.

Concepts	Questions about media texts	Questions about media technology
Social Constructivism All information is co-constructed by individuals and/or groups of people who make choices within social contexts.	Who are all the possible people who made choices that helped create this text?	Who are all the possible people who made choices that helped create this piece of media technology?
Languages / Semiotics Each medium has its own language with specific grammar and semantics.	How was this text constructed and delivered/ accessed?	What kind of text does this piece of media technology allow us to create?
Audience / Positionality Individuals and groups understand media messages similarly and/or differently depending on multiple contextual factors.	How could this text be understood differently?	How could this piece of media technology be used and appropriated differently?
Politics of Representation Media messages and the medium through which they travel always have a bias and support and/ or challenge dominant hierarchies of power, privilege, and pleasure.	What values, points of view, and ideologies are represented or missing from this text or influenced by the medium?	What values, points of view, and ideologies are embedded in this piece of media technology, missing from it or influenced by it?
Production / Institutions All media texts have a purpose (often commercial or governmental) that is shaped by the creators and/or systems within which they operate.	Why was this text created and/or shared?	Why was this piece of media technology created?

Social Justice Media culture is a terrain of struggle that perpetuates or challenges positive and/or negative ideas about people, groups, and issues; it is never neutral.	Whom does this text advantage and/or disadvantage?	Whom does this piece of media technology advantage and/or disadvantage?

Table 1: Media Texts and Media technology Analytical Grid

Phase 1 activities focused on AI technology development and concerned issues related to 'labour' or 'art'. The analytical grid will be adapted according to the theme of the new activities. Moreover, the use of the grid is not restricted to the analysis of students' questions and participants may use the grid at some stages of the educational program to help them question their own piece of technology and the one designed by others.

To evaluate the complexity of students' questions, I will define a set of indicators that will distinguish a critical from a non-critical questioning. To this end, I will refer to the features mentioned in the literature review, which explain what makes critical design and critical media literacy 'critical' (see "1.5."). Indicators will include, among others, students' ability to create their own meanings and identities (Ferguson, 2004) and students' ability to shift their perspective of a given phenomenon (Bardzell & Bardzell, 2013) that seems to have manifested itself in the first phase of the research as the overcoming of a solutionist perspective.

Conclusion

In the digital age, media education faces new challenges, such as the proliferation of online resources, the globalisation of media markets and the rise of user participation. The aim is no longer to provide a set of knowledge or skills that contribute to the development of young people's critical thinking, but to give them the tools they need to comprehend today's digital world. To empower students to think independently and critically, a number of researchers have developed inquiry-based learning models (Funk et al., 2016; NAMLE, 2014; Thoman et al., 2008) which encourage students to ask key questions about media texts.

Although inquiry-based learning models are effective in developing media literacy, they focus mainly on the analysis of media as 'texts'. Critical design proposes another way for developing critical thinking through the production of prototypes. As Dunne and Raby (2013) explain, "critical design is critical thought translated into materiality. It is about thinking through design rather than through words and using the language and structure of design

to engage people" (35). Critical design uses design fiction to challenge narrow assumptions and question the role of products in everyday life. By using design fiction as a critical inquiry method, this paper has aimed to fill a gap in media education and proposed to develop critical media literacy through both media texts analysis and media technology prototypes production. Moreover, the paper has addressed the lack of structured procedures for assessing critical thinking and proposed a method assessing students' ability to question critically both media texts and media technology.

Footnote

1. 'Hack to The Future' project website: https://hacktothefuture201.wixsite.com/httf/decouvrir
2. 'The Tarot Cards of Tech' website: http://tarotcardsoftech.artefactgroup.com/

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