Creative Information Use Among Young Adults: Challenges for Learning and Opportunities for Media (Re)Design

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ABSTRACT
Despite spending significant amounts of time on the Internet, today's young adults often do not use online information effectively to support their creative pursuits—an activity we refer to as *creative information use.* In this exploratory study, we interviewed 19 media art college students in Hong Kong to understand their creative information use and to identify the challenges they faced in engaging with creative information online. The interviews reveal that young adults lacked sufficient media literacy to negotiate information online. More importantly, our study suggests that parents, teachers, and peers often failed to collectively sustain young adults' media-related interests and creativity development. We discuss research gaps in HCI and the design of technologies, and raise important issues of creative information use for future studies.

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Internet; self-directed learning; information use; sociocultural; young adults.

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H.5.3. Group and Organization Interfaces: *Computer-supported cooperative work*.

INTRODUCTION
According to Lassig [40], creativity does not arise from nowhere, unlike suggested in popular statements such as thinking-out-of-the-box. Instead, she defines creativity as "the optimal interaction among personal, process, and social and environmental factors by which an individual or group produces an idea or product that is judged to be novel and appropriate by experts of a relevant context" [40]. Thus, an important prerequisite of creativity is everyday learning of areas of knowledge in order for a person to build up "deep understanding of well-established patterns of thought or principles"—so as to produce an unusual work that defies such established knowledge [40,66]. While HCI has examined institutionalized supports, such as interfaces, artifacts, and classroom activities helping young adults' acquiring such forms of information [12,20,33,36], we have not examined their challenges of learning this information in their free time, and within their everyday and natural environments outside classrooms.

In this paper, we define *creative information use* as the appropriation of information resources, including social media and web tools, to develop media practices and skills that are relevant to creative work such as video production and software animation. Recent research argues that most young adults have not yet acquired a level of creative information use that is expected in workplaces, thus points to the challenges of translating online learning into professional skills [5,9,22,35,42,50,57]. Researchers have associated this finding to ways in which young adults have only used a small set of social media applications like Facebook for the purposes of managing their peer relations [8,31], as danah boyd describes: "[teens who] are 'addicted' to their phones or computers are actually focused on staying connected to friends" (p. 7); and "many of today's teens are indeed deeply engaged with social media and are active participants in networked publics, but this does not mean that they inherently have the knowledge or skills to make the most of their online experiences" (p. 176).

What makes it difficult for today's young adults to engage in learning activities that lead to professional development? Is this limitation due to challenges in technical design of the online media they interact with daily, or other more profound reasons in their social lives? Selwyn [57] notes that current research studies have yet to provide sufficient details describing how young adults develop information research skills through their "information and technological lifeworlds"—in other words, the *information ecologies*, or contexts in which young adults interact with information, spanning home, school, and communities [47]. Previous survey studies also identified many demographic factors that are associated with young adults' information use abilities, such as college major [35], age [35,42], gender, and being an International or local resident (Internationals tended to spend

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more time online) [31,35], as well as socioeconomic status and family environment [22,35]. While these studies illustrated the circumstances under which certain young adult populations are doing better than others [22,31,35,42], why and how these circumstances influence online behaviors is unknown.

Studying young adults' creative information use may contribute significantly to the design of creative learning platforms. For example, we may point out hidden needs of classroom learning platforms (e.g., [1,13,15,21]), and how these could be connected with young adults' social life outside of the school environment [18,27]. In this research, we ask the following research questions: *What are the young adults' experiences of using information, particularly on the Internet, for the purposes of creative work? What are their experiences developing such information use practices in their own information ecologies? What challenges did they perceive, and how can technologies be (re)designed to support their creative information use?*

To address these questions, we examine a specific case of creative information use among a group of 19 media art college students in Hong Kong. Our informants were between 21 to 25 years old, and were expected to be proficient in various media production skills such as animation and computer game development. These skills exemplify the importance of creative information use we aim to study in this research—skills that involve the use of technologies, and require a certain degree of acquiring and making sense of information online. Our study shows that despite owning computing devices (e.g., smart phones), and having constant access to the Internet resources, the young adults we studied still experienced difficulties in creative information use. We found that the most immediate barrier reported by a majority of our informants is the lack of inclination (i.e., desire to learn) and basic knowledge (e.g., technical nomenclatures) in engaging with online information. In addition, our informants also reported deeper barriers such as the lack of offline support at home and at school in life prior to entering college, which suggest the importance of examining these contexts in the cultivation of the youth's creative information use.

YOUNG ADULTS' CREATIVE INFORMATION USE: IDENTIFYING DESIGN SOLUTIONS TO AN ECOLOGICAL PROBLEM

The need to examine young adults' experiences with creative information use is a pressing issue for our society. Roughly ten years ago, the research community had believed, perhaps in an overly simplistic way, that young adults should be able to acquire technical skills very naturally through their routine and daily use of hypertext, downloads, mobile devices, digital books, and instant messaging [49]. But since then, researchers have more rigorously questioned such claims. Selwyn reported that uses of media information by young adults are "passive, solitary, sporadic and unspectacular" [57]. Similarly, in her book *It's Complicated: The Social Lives of Networked Teens* danah boyd [8] also found that extensive use of the Internet among teens is often centered on social network and friendship building, instead of developing the knowledge and skills to fully use the technologies.

Demographic Studies on Young Adults' Internet and Technology Uses

To understand what might affect young adults' self-learning and creative information use, many researchers tried to identify factors associated with effective creative information use [9,10,22,35,42,43]. One demographic factor that is particularly relevant to young adults' information use is the number of computing devices they own. For example, Helsper et al. [22] surveyed 2350 users (14 years old and older) regarding their frequency of using the Internet for various tasks, including fact-checking and getting information for work. They found that age alone does not account for much variation across the sample population; however, the number of computing devices in each of their homes correlates with how much the participants use the Internet for academic and work purposes [22].

Other demographic factors associated with frequency of creative information use include the students' college major, and whether they are Internationals or local students. Brown and Czerniewicz [10] conducted a survey with South African college students and found that schools centered around technological studies (e.g., engineering schools) are more likely to incorporate Internet use as part of classroom activities, while schools which do not emphasize technology are more likely to overlook classroom technologies (74% versus 57%). This can result in students in technology-centered schools having more opportunities to get familiarized with information acquisition and other technological skills [10,35]. Furthermore, it was found that classroom instructors' technological mandate matters more than the presence of IT when it comes to creative information use, as students tend to ignore IT as a potential learning resource when instructors do not require it [42].

Technological Studies in HCI and the Perspective of Learning "in the Wild"

In a similar fashion, HCI research has also attempted designing technologies to support creative learning, but with an emphasis on classroom settings. For example, past studies have come up with design tools for collaborative learning [15,16], online discourse [21], performance prediction [13], user interfaces for managing classroom activities [1], as well as classroom-based activities [12,20,33,36]. Such artifacts and activities are designed to enhance the media-richness of today's learning technologies in the classroom settings; however, there is little evidence that young adults are becoming better information users in their natural environments (i.e., Internet use in their own free time) because of such interventions. A confounding factor is that classrooms are only one part of youth's learning environment. Learning is also occurring outside of classrooms, through

interacting with parents, among peers, and within specialized and technical communities. And this form of learning is particularly relevant when the youth become young adults pursuing creative professions. Importantly, among these previous studies on demographic factors and classroom technology design, less often discussed are the in situ sociocultural conditions fostering creative information use. Thus, researchers are arguing for a more detailed and naturalistic examination of young adults' learning "in the wild" to identify a more effective way of situating such tools within their information ecologies [9,35,57].

Sociocultural Aspect of Young Adults' Learning

To address the lack of understanding of sociocultural aspects of young adults' learning, a few studies have emerged to examine youth's verbal accounts and actual experience of learning creative skills [8,26,27]. Importantly, these studies found that technological artifacts are never truly neutral—a young adult who has many computing devices at home may have parents who are IT savvy, and have intentionally cultivated a media-friendly home environment [37]. Therefore, Selwyn [57] recommends a concrete examination of ways information use practices have been nurtured over time and across a spectrum of social circumstances within young adults' environments:

> Adults would therefore seem to have a continued role in supporting young people's use of technology and information, not least in ensuring that the social contexts surrounding digital information allow young people to be informed about their choices. Of course, many of the research findings in this area point towards "the need for additional training" of young people with regards to digital information [6], and addressing the "chasm" that is felt to exist between "the rather basic needs" of children and young people and "the complexity of the [information] resources" they use [44]. Yet rather than concentrate solely on the technical training of young people, efforts also need to be made to explore the ways in which "critical digital literacies" can be developed. (p. 374)

Importantly, Selwyn specified that learning of creative media skills does not occur merely online; it is also mediated and influenced by a series of actors, including parents, teachers, media content providers, and librarians.

In parallel with the effort to understand how sociocultural forces come together to cultivate creative information use among young adults, there is the development of an agreeable set of *media literacies*—information skills young adults need in order to succeed in future workplaces [22,50,57]. For example, a concept of media literacies developed by Jenkins [28] includes *judgment literacy*, which refers to "the ability to evaluate the reliability and credibility of different information sources." Another example includes Jenkins' *play literacy*, defined as "the capacity to experiment with one's surroundings as a form of problem-solving," for example, "to pick up a new piece of technology that you've never used before"—and to become curious about, mess around with, and engage in a new media activity. In other words, creative information use could be decomposed into a set of learnable skills, which are also generalizable across research sites. Thus, while we are investigating creative information use, it is also pertinent to identify such skills which young adults deem themselves lacking.

In summary, despite the use of learning technologies in and outside of classroom settings, many young adults still encounter difficulties engaging in creative information use. Thus, there is a need to conduct in-depth studies to investigate these young adults' information ecologies across different settings, and to identify deeper and more complex reasons accounting for the lack of effective creative information use in today's information- and media-rich learning environments. Next we will discuss the methods we employ in examining our young adults' learning environments.

METHODS

To investigate young adults' creative information use, and the challenges which prevent them from engaging with creative information effectively and deeply, we conducted semi-structured interviews with 19 current college students and recent graduates recruited from a media art college of a Hong Kong university. The curriculum of media art school focuses on skills related to digital media, providing training in subjects such as animation, games development, photography, and music. Many students in this school had been long interested in art-related subjects, and many wished to become creative media professionals upon graduation. Within the school, classes were typically project-driven, where students are incentivized to acquire professional media art skills and to work with peers to enhance their skills. We picked this sample population since, due to rapid technological development, young adults interested in becoming media art professionals often have to engage in a significant amount of creative information use in their spare time, both for excelling in classroom projects and for career development after school. Thus this population is ideal for us to understand the challenges and obstacles for young adults to engage in deep creative work oriented learning. Because of these unique features, we were more likely to elicit more data per interviewee regarding creative information use than with most other populations [59].

Our participants were recruited through class announcements (three), and the snowball sampling approach (16). There were 13 females and six males. Among these nineteen participants, thirteen of them were existing students and the other six had graduated for no more than three years. Sixteen of our informants were local students who grew up in Hong Kong, while two were from mainland China, and one was an exchange student from Germany. The informants ranged between 21 and 25 years old. Interviewees were given $50 (approximately US$6.50) as a token of appreciation.

All interviews were conducted in person and each lasted between 45 minutes and an hour. At the beginning of each interview, we started by asking the informant to list his or her creative interests. Then, we asked questions regarding how participants sought information to support their creative interest development. In doing so, we were able to ask follow-up questions regarding the participants' information use and skill developments in relation to these interests. We did not explicitly ask for information on the Internet, so that they could provide a whole spectrum of information resources useful for their creative work. This approach also allowed us to probe why sometimes online resources were found ineffective. Toward the end of each interview, we inquired about obstacles that may have prevented them from engaging deeply with creative information use online.

All interviews with local Hong Kong participants were conducted in Cantonese (a Chinese dialect that is the main language used in Hong Kong). The interviews with mainland participants were conducted in Mandarin, and the interview with the German student was conducted in English. The interviews were audio-recorded, and transcribed in the original language of the interview. For non-English interviews, the quotes were translated into English at the writing of this paper. All informants' names were anonymized and replaced by pseudonyms in this paper.

Analysis

In our interviews, most informants named more than one creative interest, with an average of 6.26 per person. Despite the number of diverse interests, most of them chose to focus on developing one or two interests at a given time. When participants engaged in two interests, they often chose two that had sufficient synergy to be practiced at the same time—for example, the study of both photography and film enhances knowledge in cinematography, involving the study of light and motion-picture technology. Similarly, animation interest was found to be associated with painting and graphic design; music with digital instruments and song composing; and computer gaming with console games, online games, game video making, and computer programming.

We identified seven major clusters of creative interests, of which we focus on the four most commonly reported ones for our analysis: animation (reported by 9 informants), computer gaming (11), photography and film (11), and music (8). The remaining three interest clusters include cooking (4), dressing (5), and reading (6). Since these three clusters of interests have weaker association with technologies, we did not include data related to these interests. We then conducted a grounded theory-based iterative and inductive analysis of our transcripts, using coding and memoing [61].

Note that our coding did not reveal a standard and general approach to creative information use across all these different interest domains. The reason is that the sources of creative information in each domain vary greatly, depending on where the domain experts congregate and share their expertise. For example, creative information about digital music composition may be available on YouTube, but information about animation is largely found on *Vimeo*, a video-sharing site similar to but slightly older than YouTube and extremely popular among some video production communities. Location of creative information also varies from region to region; for example, music players in Hong Kong may heavily use Cantonese-speaking websites such as HKGolden (hkgolden.com).

Therefore, we coded the sources of *creative information* on a case-by-case basis. Our third and fourth authors were undergraduate students of the media art school, and they coded the *creative information* based on their knowledge of these domains. For example, within the case of animation, we developed codes including "personal purpose," "social influence," and information sources like "common media" like YouTube, "domain-specific media" like Vimeo, and media "creation" activities.

At first, we were also looking for ways our informants were using online information creatively. But half way through our interviews, we realized that our participants were driving our interviews towards challenges and issues of creative information use that are deeply embedded in their social and cultural contexts. For example, among participants who were interested in animation, only two out of nine informants had ever created animation—and both were made for the purpose of university assignments. Thus, we gradually switched our focus to identifying their obstacles in creative information use. Typically, our informants had reported gaps related to media literacies, describing their experiences with others at home, in school, or with peers. For the earlier informants whom we had not covered these issues sufficiently, we performed follow-up interviews to clarify points they had made earlier. We coded the reasons for these problems as data, iteratively throughout the process of the interviews, until we identified a structure in our data, as we will discuss in the Findings section.

FINDINGS

Our analysis identified several reasons accounting for young people not engaging in creative information use. In this section, we will describe the challenges of using creative information when a user lacks media literacies, and report on other difficulties within the contexts of our study. Note that media literacy takes years to develop, and a person builds media literacy through years of experience and engagement in a media-related interest (see [4]). As such, we have also paid attention to how our informants' creative information use is accompanied by their journey in learning a creative interest.

Media literacies: Creative Information is Difficult to Use

Importantly, despite our young informants handling and using computing devices regularly, most of them still reported having difficulties searching for, identifying, and using creative information. We describe these challenges in the following.

Hidden Knowledge Structure in Creative Information Content
Our informants reported that creative information contains hidden structure which they first need to know before they could use it to produce meaningful digital artifacts.

Jane graduated from the media art college two years ago. She has loved watching animation since she was little, and started learning animation, through using a software tool called *3D Studio Max*, in middle school. However, at the media art college, she found that it was very difficult to learn the more powerful animation tools used by professionals. For instance, when she started learning the animation software tool *Houdini*, a powerful animation tool popularly used among professional animators, she was put off by the degree of hidden prerequisites in Houdini—the mathematical knowledge needed in order to control movements of 3D particles and models:

> [Apart from just animation] you still have to learn a lot of things on your own. And also some programming language, like those used in Houdini, which includes mathematical calculations. All these are necessary [in animation]. You have to memorize and learn a lot of things. If you haven't learnt [these] before, you will run into so much trouble [with animation], and [many things you like to accomplish simply] cannot be done.

Because of this hidden knowledge gap, Jane had to switch her major from the media art program to Chinese and history. While she has remained interested in animation, she has given up doing it as a career option. In Jane's case, her unsuccessful appropriation of Houdini was due to lack of media skills she needed—mathematics and programming—appropriate for animation production. This missing experience hindered her learning of animation.

Creative Information Contains Technical Nomenclatures and Language
Our informants reported that, unlike textbooks that contain necessary introductory information, online information is often written with technical nomenclatures and language which are difficult to comprehend unless the user understands these foundational discourse elements.

At the media art college, John had attended college courses on programming, but he had found the college curriculum insufficient specifically in understanding software data structure. John had tried to find more information on the Internet on his own. However, he was unable to find much useful information due to his inability to understand the online discourses and Internet jargons, and to identify usable programming codes:

> I seldom use the Internet, because I think there are a lot of fake codes on it. The forums are worse. They often speak in difficult languages, and I don't even know what they are yakking about (唔明佢 Up 乜).

For John, he found that there were many programming scripts which did not work as he had anticipated—they lacked sufficient explanation of fundamental concepts and were not written in easily understandable language. And he found that the use of creative information (e.g., data structure description) contained other nomenclatures too challenging to understand on his own.

Creative Information is Hidden in Specialized Online Communities
Our informants reported that creative information is often located in specialized online communities they would not know existed unless they knew where to look.

Mary learned piano in middle school, and had participated in music bands at her church. When she started as a media art student, she tried to use the computer to compose a song. However, like other Hong Kong students who had only attended Chinese schools before college, she had difficulties comprehending Google search results written in English. Quite surprisingly, despite youth like Mary being avid social media users, she did not think of YouTube as an information source at first. Only after a long time of rigorously using the software tool through trial and error, and when her friend advised her to use YouTube, did she discover the resources on the website:

> But earlier on, I did not know how to find out what others had done [in study music composition] ("鑽研"), and I thought that I just had to learn the software directly. I did not know that there are tutorials available on YouTube. If not for my friend who had told me, I would not have known. Ya, and I really thought that I need to rely on other people or on the lectures to learn. I felt so stupid at that time.

In Mary's case, it took her a long time and through her personal network to slowly develop knowledge of useful resources for learning music composition. Despite all the information available online for free, the knowledge about where to find such information, how to identify the most useful tutorials, or even which person to follow on YouTube requires extensive work and it did not come to her naturally.

Our informants reported many challenges in using creative information. Notably, most of these challenges were caused by their lack of exposure to foundational skills, discourses, and communities related to the technical knowledge. In other words, the more a user is conversant and feeling at ease in a knowledge domain, the better she is equipped to pursue creative information use—thus constructing a positive development spiral. In the following section, we will describe where these supportive factors may come from, by examining data regarding our informants' sociocultural environments.

Social Recognition: A Lack of Companionship in Creative Information Use

Our informants did not only report challenges of using creative information, but also discussed how their relationships with their teachers, family members, and peers influenced their motivation in attempting to overcome these challenges. In this subsection, we describe these variables—

companionship and recognition—and how missing them may influence young adults' willingness to engage in creative information use.

Companionship: Opening the Door to Creative Information Use

Our analysis shows that before a user can make proficient use of creative information within a technical interest, it would be helpful if he had companionship in real life to support him in this interest. For instances, our informants who were interested in animation also tended to pay attention to anime events and activities related to *cosplay*—the dressing up of oneself to look like characters in animation, games, or comics—an activity many animation lovers enjoy. Anna started watching animation since she was in ninth grade. However, she relied on companionship, such as through attending a cosplay event, to start delving deeper into the interest. She stated, "I am not that nerdy and isolated" ("我又未至於毒成咁既") and "will only attend cosplay events if my friend is attending. Otherwise I am not going to go there alone." She still follows new anime releases every week, but she may not go further than that without sufficient companionship.

Another informant, Lung Fung, was a PC gamer until he realized that PC games are not the most popular anymore:

> Why? Because now I am not playing games I was playing in middle school. Because very few people are playing these games nowadays. In Hong Kong, the mainstream trend is no longer about playing PC games, but many have started playing mobile games.

As this quote shows, in a fast developing field, willingness to engage in difficult online discourses relies on being part of a community. If a large part of one's social network is not participating in the activity, the desire to pursue the interest might diminish after the initial interest.

The need for companionship—a friend who would perform the activity with the learner—is especially salient among informants who were newly exposed to a technical interest, and had yet to venture into deeper engagement with it. Thus, companionship can be viewed as a key mediator providing conditions for information users to transit into deeper information practices.

Recognition: Sustaining Efforts in Creative information Use

Even with companionship, young adults may not feel confident enough to engage in creative information use if they fear that they are not good enough to be recognized by their peers. We use recognition to refer to positive peer feedback (e.g., Facebook comments) and social interactions one receives from others.

One way for our participants to progressively deepen and engage with creative information use was through contributing textual contents online; such participation was a critical initial step for them to fully embrace and benefit from the online resources [11]. Mario was an avid consumer of game contents on live streams and on YouTube. However, he had seldom commented on YouTube, partly because other viewers had often ignored his point of view. He told us:

> I seldom left comments on YouTube, as I still feel that few Hong Kong YouTube users look at these comments. This [lack of interest in comments] make commenting meaningless. But when it comes to Facebook, people commonly share the videos and photos that they own or come across, and the chances you get feedback [on such content] is higher.

Instead, Mario invested more of his online commentary on Facebook, where he felt that there was a higher chance of seeing feedback due to presence of his personal friends. This observation reinforces the finding that companionship is needed to sustain information practices, and extends it to include the need to be recognized by other users.

The importance of companionship and recognition indicates the role of supportive peers and mentors within animation, computer gaming, and music in the context of engaging with creative information use continuously and more deeply. Without such supports, our informants often lost interest or could not dive deeper in their interest development.

Next we introduce factors, including routines and constraints within information ecologies, which drive our participants away from creative information use.

Media Selection: A Lack of Legitimization by Parents and Authorities Impact Users' Choices of Media-related Activities

For many creative interests, such as computer animation, skills and knowledge in its practice needs to be accrued over time. Thus early access to equipment and resources is critical to one's initial interest and later career development. But such access is highly dependent on parental encouragements.

When the informants in this study were young, many of them looked to their parents or schools to provide classes to teach them the technical skills needed in their interest development. We noticed that our informants tend to believe that *learning has to be endorsed and supported by parents and schools*; they rarely mentioned instances when they pursued self-directed learning in creative work, like the way they had picked up social media like Facebook naturally and in a self-driven way. Subsequently, when our informants failed to acquire any media skills, they pointed to the lack of support from public schools and parents as the main reason for their missing proficiencies.

For example, Veronica, a student at the media art college, was interested in visual art. She mentioned that during her middle school, she became interested in software tools like Adobe Illustrator (AI) and Photoshop. However, the lack of visual art courses prevented her from engaging with the subject further:

> I love the idea of using computers to create things, such as using Photoshop or AI [Adobe Illustrator] to create

> media stuffs… but I did not have the choice of art courses at school.

This *common logic* of requiring legitimization from parents and schools is not present in the case of photography and games, however, since these are not subjects typically associated with academic learning.

Lung Fung was pursuing an Associate Degree, and had taken courses at the media art college. While he was an exceptional student, with above 3.5 GPA (out of 4), he had stopped producing music as a hobby as he was overwhelmed with school work geared toward his major. During the interview, he told us, "I have in fact stopped playing guitar already. I am busy doing other stuff, with less time to play [guitar]. Eventually, I became so busy I had to give up playing entirely." In Lung Fung's case, guitar was viewed as a hobby that would only distract him from pursuing other more serious career goals. The lack of parental legitimization led to him dropping his music-related activities.

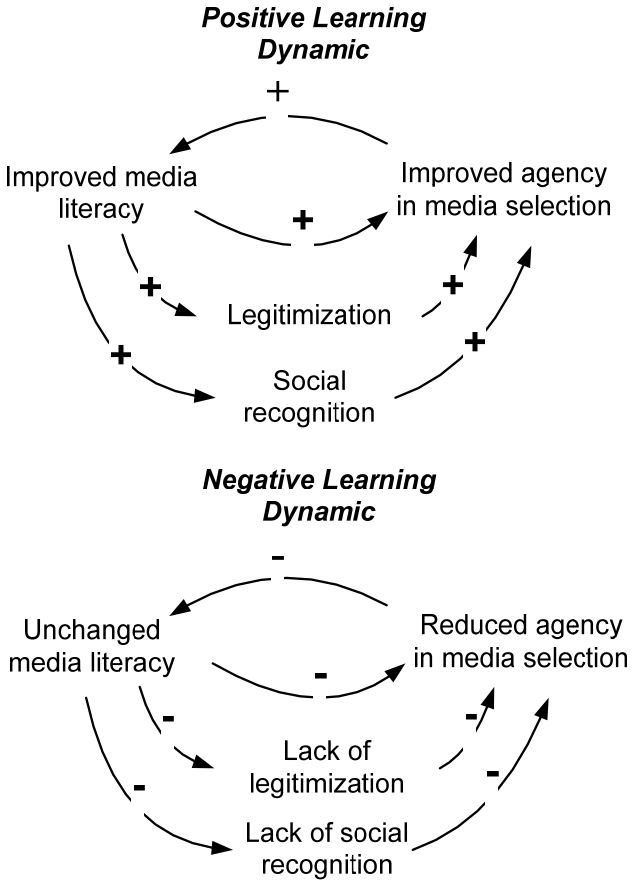

Figure 1. Positive and negative dynamics of media literacies development.

However, when we contacted him again informally to verify some of his quotes, he had just received an offer from the media art college to enroll as an undergraduate student. He was overjoyed to be able to continue studying digital music making, something which he had nearly given up in his pursuit of higher education.

> Yes, I want to continue (the music interest), now that I have the offer… Now I hope that I can continue to cultivate music practices. And [in my associate degree] I am going to compose a music piece. And therefore I can continue to keep doing music, even after my [Final Year Project].

Like recognition, legitimization of specific interest activities can persuade or dissuade these students from deepening their creative information use. But legitimization is different from recognition, in that the endorsement comes not from peers, but from authorities like parents and institutions. These authorities tend to set boundaries, control pedagogical resources, and impose learning routines which can affect learners' development trajectories.

Thus, the degree each interest is being legitimized depends on how it is being viewed by the parents and teachers—as being a real creative work, or simply recreational and optional. This tendency for authority figures to endorse interests unfairly was pointed out by Bourdieu [29], who noted that, for example, the French museums and universities have tended to legitimize "music, painting, sculpture, literature and the theatre" as high culture, while other forms of art are often seen as "deviants" and of a lower status (p. 123). In a similar fashion, our informants learned, in their upbringing and interaction with the authoritative persons in the context of Hong Kong, that legitimized activities are the "productive and proper" activities, leading to a loss of motivation in pursing any interest not endorsed as such.

In Figure 1, we term the informants' choice of media-related activities as *media selection*, and present the complex interactions between media literacies and related sociocultural factors in a simple *system dynamic model*. We use this model to provide a "feedback view" of how such a sociotechnical system works, instead of showing one-directional causal relationships between system elements [60]. We found this modeling approach fitting since we like to show how media selection, social recognition, and legitimization reinforce each other within an information ecology as the learner develops media literacies. For example, a high school student who is already good at music has a higher chance of getting into a media art college, and subsequently gaining further legitimization and media selection agency. In Figure 1, the top diagram shows a simplified positive feedback system with positive learning dynamic (depicted by "+" signs), and the bottom diagram shows a negative learning dynamic (depicted by "-" signs). As Figure 1 points out, there is no one single factor that impacted our participants' creative information use. Rather, their choice of how to make use of the rich information offered on the Internet hinged on the complex and intertwined factors situated within their sociocultural environments of learning. In other words, a young adult may thrive in an ecology with adults and peers willing to legitimize and recognize his media literacies; but another young adult without support from others will quickly lose

interest. These findings highlighted nontrivial challenges for technology designers, if we are to resolve such sociocultural issues impeding creative information use.

DISCUSSION

This paper contributes to the understanding of young adults' difficulties in creative information use in learning creative skills from a sociocultural perspective. On the surface, when the young adults interacted with media technologies in the media art college, they reported insufficient conceptual understanding of a technical topic, or unfamiliarity with its discourse structures and nomenclatures, which made it difficult for them to use online creative information effectively; *but through our in-depth analysis, we found that these young adults' lack of sufficient media literacies may be an outcome of how parents, teachers, and peers had jointly influenced their media selection agency through social recognition and legitimization*. From Bourdieu's [46] point of view, logical arguments such as "I did not have the choice of art courses at school" can be a thought pattern habituated through social learning in the course of their interaction with others, and the person would hardly consider alternative arguments at the moment of conversation.

Based on this sociocultural view, we reasoned that creative information use is a problem that cannot be resolved by simply redesigning artifacts, such as online learning resources, to be simpler, easier, or more functional. Instead, as shown in our research, the problem with creative information use is deeply rooted in young adults' information ecologies, and particularly, their embodied interactions with others at home, in school, and in the community. And since most young adults have experienced learning within the structures of home, school, and community, their sociocultural influences should be generalizable across most creative information use cases.

When our informants with low media literacies found the effort and time in engaging with a new interest topic too steep, they initially rationalized (in our interviews) that they encountered a "lack of [time, skill, teacher]" to continue pursuing that interest. However, deeper into our interviews, they also reported that the strength to persevere in these interests has to come from a sense of their efforts being recognized, and the activity legitimized, for them to feel justified incurring the mental effort to overcome the difficulties. Thus, the desirable way to foster creative information use may be to allow users to feel socially supported by their parents, teachers, and other learning partners. .

For a specific creative interest, we have found it takes years of engagement to develop the necessary media literacies. For example, it was difficult for informants like Lung Fung, who was only encouraged by his peers but discouraged by parents, to focus his attention on pursuing a digital music career—until he realized he was accepted (i.e., being *legitimized*) by the media art college. Thus, it is important to recognize that the mediation of information ecologies to foster positive learning dynamics is a multi-sited problem that spans across home, learning institution, and communities, and as a result is being affected by all of their practices.

Thus, what most of our media students encountered was a widely observed issue of insufficient social support of creative information use activities in school and at home, which is difficult to uncover but yet essential for their interest and professional development, as was discussed by Bourdieu [46]:

> The competence of the 'connoisseur', an unconscious mastery of the instruments of appropriation which derives from slow familiarization and is the basis of familiarity with works, is an 'art', a practical mastery which, like an art of thinking or an art of living, cannot be transmitted solely by precept or prescription. Learning it presupposes the equivalent of the prolonged contact between disciple and master in a traditional education, i.e., repeated contact with cultural works and cultured people. (p. 66)

In our study, we can take "cultural works and cultured people" as referring to media technologies and content, as well as supportive adults and peers who are media literate. For example, a mother who engages in producing digital music with her daughter—playing digital instruments with her on a weekly basis—will over time cultivate within the family the positive interactions, and a routine use of associated nomenclatures, to establish the sense of legitimacy of that activity.

But the existence of "cultural works and cultured people" is sorely missing within the information ecologies of our informants. Even though Hong Kong has a GDP per capita of US$28,224 in 2005 (when our informants were teenagers), many of our informants reported having only limited access to ITs (e.g., the Internet), and its practices (e.g., training in Photoshop). Rather than labeling these parents in Hong Kong as "poor," as may be suggested by previous studies, we may attribute this limitation to the local parental and educational priorities in cultivating the students to excel in traditional school subjects. In Hong Kong, like some other East Asian cultures, parents are known to keep children under close supervision, while emphasizing only activities contributing to better school grades and a set of normative career options [48]. In this sense, the media culture deficiency in Hong Kong may be contrasted with the incredibly positive technological learning culture of regions like Silicon Valley (cf. [3]), as well as with other cases of supportive parents we had identified in our previous work [37]. Interestingly, while the expectation and close monitoring from parents and teachers often ended when our informants entered college (when some of them identified their true career passions), by that time, some of our informants found themselves so far behind in media literacies that the challenges they experienced in creative information use seem insurmountable—like Jane, who was discouraged by the

amount of time she would have to put in to master new 3D animation software tools, since her previous classes had hardly prepared her for these challenges.

Prior research in HCI has suggested that people would most likely first get in touch with computing devices at home, making that an important media learning site for these young adults [22,57]. In particular, Jones, et al. [31] have speculated that simply increasing the number of IT devices in students' homes will assist their media learning process. Nevertheless, the findings of the current study suggest that, instead of focusing on IT devices, parental interactions with their children may play a greater role in youth's creative information uses. For example, such practices may cultivate in these children the notion that devoting time on media production is a productive or simply a recreational activity [22,57]. We need to keep in mind that in our findings, hardly any informants mentioned parents as their motivators, which comes back to the ways creative media activities often seem recreational and optional. And when an interest is deemed "recreational," its activities may appear as a distraction—an unnecessary waste of time—particularly at stages when the youth have to work very hard to do well academically. Accordingly some of these youth may lose their best years at learning media technologies, which would prepare them to engage with creative information in later life.

Hence, learning and engaging in creative information use is a complex sociocultural issue, and there is no "silver bullet." In the next section, we will point out research gaps and design challenges in creative information use, in the hope of shedding light on how HCI research might address this complex problem.

Integrating Learning Technologies into Children and Youth's Learning Ecologies

We argue that if technologies could allow parents to integrate media learning into their parenting practices—in the same way as they had integrated traditional literacy learning with books—youth and young adults may be able to cultivate creative information use more effectively.

In some ways, design research in HCI has already made significant progress, from examining technology-supported learning of traditional literacies (reading, writing, speech, and critical thinking [7,38,64]), to tools which *mediate media literacies acquisition* such as programming skills [34,62]. For example, Storytelling Alice is a programming environment which allows young learners to code and modify the way animated characters act and narrate a story [34]. Programs like Storytelling Alice provide children with visible and observable outcomes that have been found to motivate their learning [24,34,45,62].

Despite these advancements, we still lack sufficient understanding of how these tools can be accepted and integrated by parents and teachers, who in our data were hardly mentioned by our informants except in cases where they turned out to be hindrances. Our informants reported parents only being supportive of academic pursuits, and in some instances, non-academic but classical art interests like piano (e.g., in our informant Mary); and in contrast, nearly all other reported media interests (e.g., coding, gaming, and 3D animation) were not sufficiently understood and supported by parents.

Similarly, we also found that media-related interests were often sidelined in formal educational settings. For example informants like Veronica did not find support at her middle school for learning professional graphics software tools. The same finding has also been reported in other studies. For example, in the examination of iPad deployment in classrooms, few teachers were found to have used these iPads to teach computing skills (e.g., to produce a digital movie) (4%); rather they were mostly relying on these new computing devices to teach traditional subjects (39%); and the rest (56%) had not used the iPad at all [41]. We agree with Jenkins et al. [28] that, while providing classrooms with computing devices is important, we need to pay more attention to how these devices are being used by teachers and students. Creative information use among our informants was always motivated by animation, music, photography, or computer gaming—which are the true motivations which teachers need to support.

Another concern is that the level of adults' engagement in teaching traditional literacies versus media literacies is currently imbalanced. For example, in the HCI literature, traditional literacy sharing (e.g., reading together) is well accepted by parents, and is reported as family-centered, voluntary, open, and welcoming [17,51,53]; in contrast, technology uses (e.g., media consumption) were seen as intrusive, private, disruptive, and addictive [23,56]. In fact many HCI research studies have only focused on supporting traditional parental agendas, such as providing technologies to engage children to read books online with their parents or grandparents [17,52,54], but not on other forms of media use.

From our sociocultural analysis, this contradiction may be resolved by providing parents and teachers with learning tools with which they can engage with the young adults on equal footing—transcending the more traditional supervisor-supervisee relationship; that is, adults could directly participate in the young adults' media activities, rather than only acting as supervisors. Nonetheless, we fully understand that most parents may still lack sufficient understanding of media technologies themselves to perform the activity comfortably with their children. But by providing this suggestion, we hope to at least point to useful directions which researchers and designers could work toward to resolve this issue.

Furthermore, to support long-term engagement with creative information use among young adults, we need learning artifacts which parents, teachers, and peers could act on collectively, in a complementary way, to lead to the learners' acquisition of media literacies in their everyday consequential learning [27]. Therefore, there is an urgent

need to examine the collaborative use of media technology between children and parents, or with teachers; in these scenarios, these adults do not act as an authority or supervisor, but as play partners, in which both parties collaborate to manipulate information, produce media artifacts, and so forth [58]. At the writing of this paper, commercial courses for children and youth (e.g., in Minecraft and Scratch programming) are already emerging popularity in places like Hong Kong, and we may begin to examine the small number of parents and teachers who are invested in these courses and actively cultivating media-related skills among the young adults.

But to fully address the lack of support of creative information use in children and young adults' learning ecologies, an underlying issue is that parents and teachers need to see the academic value (e.g., in gaining admission to a university) of youth engaging in media literacies learning. In this regard, one promising area of work which HCI may engage in is the accreditation of media literacies learning outside school curricula. While HCI has examined how point awards and other digital representations may motivate learning [14,25,30,39,63,65], these points awarded for online forum participation do not explicitly build up to any real certification [2]. Also, the activities awarded often have little to do with actual acquisition of media literacies (e.g., having made a robot, or learned a software), but more to do with posting comments on a forum, thus making these rewards more like 'pointless points' for learners. Outside of HCI, some computer science fields have already begun examining an experimental form of accreditation technology based on digital badges [32,55]. Badges are becoming important artifacts supporting media educational efforts—such as Computer Science Hour of Code, Code Week, and other informal media-centered programs—and it was meant for learners to have a secured and standardized way of displaying their continuous learning outcomes [19]. Computer science has examined badges used by Huffington Post [32], and MOOC courses [2], but it remains to be seen if badges earned in these contexts would have any real value in higher education and the job market.

Lastly, research examining ways of fostering strong sociocultural environments for youth and young adults to cultivate creative information use is urgent, considering the degree of the problem we uncovered in this research study. Our findings have shown that a majority of youth will less likely become the creative workers we have envisioned. Unlike traditional forms of literacy, which are continuously reinforced at home and in school, the cultivation of creative information use has largely been left to the youth and young adults themselves. It is time to think about designing technologies by which learning activities could be incorporated willingly, routinely, and positively into daily and recurrent interactions between children and other adults within their learning ecologies.

CONCLUSION

In this study, we examined sociocultural issues and technological implications of creative information use among young adults. We conducted 19 semi-structured interviews with students and recent graduates of a media art college in Hong Kong. We found a complex sociotechnical system containing multiple overlapping learning ecologies—home, school, and communities—in which young adults negotiated creative media learning. Thus, the effective engagement with creative information use may require more than just supplying the young learners with more technical sandboxes; it may mean conceiving technological interventions that could alter the culture, values, and opinions toward media-related activities which could *sustain* productive utilization of these sandboxes. Like traditional literacies such as writing and reading, there ought to be artifacts orchestrating media literacy acquisition across learning ecologies. By highlighting the importance and complexities within these information ecologies, we have hopefully provided a starting point to address this issue.

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