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APPLYING SOCIAL MEDIA TO SCAFFOLD UNIVERSITY STUDENTS' INQUIRY GROUP PROJECT WORK – THEORETICAL AND PRACTICAL IMPLICATIONS

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ABSTRACT

Aim/Purpose	This study serves a constructive purpose on the effective use of social media as a technical tool in formal learning at higher education. It outlines practical suggestions for institutions to leverage the participatory design method and refine social media pedagogies.
Background	Social media gains widespread usage from the majority of university students worldwide. Educators examine the potential of social media's affordances in teaching and learning. While the use of social media in formal learning has garnered much interest among educators, the implementation of such pedagogies remains individually motivated rather than institution-wide.
Methodology	This research empirically examined university students who took part in inquiry group project work in two courses (undergraduate and postgraduate) under implementation of participatory design approach. It adopted a mixed-method approach by collecting both quantitative and qualitative data to examine their expectations and preferences on social media tools.
Contribution	Despite the technology's potential for facilitating teaching and learning, the effective use of social media in higher education has been a recurring problem for many educators and institutions. This study addresses the deficit and proposes a

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	theoretical framework that consists of student's own experience and teacher-initiated scaffolding students' adequate use of social media in formal learning using participatory design approach.
Findings	Results indicate that students wanted to use social media to gain knowledge, collaborate, communicate with each other and embraced the implementation of the participatory design approach, which offered them a greater sense of participation and ownership. Furthermore, our research has revealed that despite generally being familiar with social media use in everyday life, students relied at least partially on their lecturer's guidance in adopting social media in the specific domain of formal learning.
Recommendations for Practitioners	To incorporate social media in education, the ultimate goal is to enhance students' use of social media tools for better and more effective learning. Our study recommends initiating organizational change in universities to the adoption of new pedagogies which allows students' autonomy and lecturer's scaffolding support to demonstrate the pedagogy's positive influence by social media in teaching and learning.
Recommendations for Researchers	Researchers could examine and compare the effects by implementing the theoretical framework suggested in this research in different education levels, e.g., secondary school education. The researchers could consider cognitive, psychological, and social factors on incorporating social media into formal learning.
Impact on Society	Social media has gained its recognition in everyday lives and academic field; however, the feasibility of social media-assisted pedagogies depends on individual educator solely. The current article provides a new pedagogy that educators can refine by students' levels of social media proficiency and their learning expectations for institutions from around the world to make the best use of social media as part of formal university education.
Future Research	With the rapid development of social media, further studies are worthy to examine the longitudinal impact of the current and the latest social media pedagogy with participatory design in scaffolding university students' inquiry group project work on potential for use in formal learning and extent to co-create collaboration with lecturers.

Keywords social media, higher education, pedagogy design, participatory-design approach

INTRODUCTION

Social media are web-based services that allow individuals, communities, and organizations to collaborate, connect, interact, and build community by enabling them to create, co-create, modifies, share, and engage with user-generated content that is easily accessible (McCay-Peet & Quan-Haase, 2016). The majority of university students worldwide use social media in their everyday lives (Dragseth, 2020; Ivala & Gachago, 2012). Compared with traditional media, which focuses on the uni-directional knowledge transmission and acquisition, social media offers flexible channels that enable active participation, collaboration, and knowledge sharing among users (Chugh & Ruhi, 2018; Mao, 2014). Educators have identified social media's potential for facilitating formal learning, and in recent years have begun devising instructional strategies that incorporate social media in education (Chen & Bryer, 2012; Hashim et al., 2018; Mpungose, 2020). Yet, social media implementation in higher education remains a decision made by individual lecturers rather than a systematic approach originating from decision-makers at institutions (Sobaih et al., 2020; Tess, 2013).

In the last decade, the author has explored pedagogies that scaffold university students' group projects on social media by conducting related research, adopting various approaches such as teacher-led,

student-led, and participatory design. Previous studies began as a teacher-led approach and discovered from the students' comments that it was desirable to have teacher's training and guidance for incorporating social media in education (Chu, 2008). And sufficient guidance and instruction from teachers are equally important to facilitate students' collaboration (Chu et al., 2013). In the early 2010s, with the increasing familiarity of social media, the author adopted a student-led approach as students were more equipped to explore different platforms. On this basis, distilling 10 years of experience and presenting findings from the latest approach – the participatory design approach, devotes to theoretical and pedagogical contributions.

First, it proposes a theoretical framework outlining how lecturers and students can contribute to the use of social media in facilitating group project work using the participatory design approach. Second, it addresses the broader issue of the lack of systematic implementation of social media in education and discusses how an innovative pedagogy, once proven effective, could be more widely adopted on an institutional level through lecturers and university policy-makers' collaborative effort.

THEORETICAL BACKGROUND

FIVE CLAIMS OF SOCIAL MEDIA, AND THREE DOMAINS IN WHICH STUDENTS CAN USE SOCIAL MEDIA

Chu (2020) reviewed that social media can be distinguished by three major themes: user-generated content, sharing and community and five claims: user-generated content/creation (Ayeh et al., 2013; Saura et al., 2019; Sensarkar, 2009), prosumer (Johnson et al., 2014; Lam, 2019; Ritzer & Jurgenson, 2010), co-creation (Rice, 2009; Staub & Hodel, 2016), sharing (Ahmed, 2019; Martin & Tapp, 2019; García-Martín & García-Sánchez, 2013), and community (Hemmi et al., 2009; Yan et al., 2013; Gomez-Vasquez & Romero-Hall, 2020). Table 1 summarises the major activities in each area and gives examples of relevant applications.

Social media can be used in three domains (Chu, 2020): everyday life, informal learning, and formal learning, illustrated in Figure 1. The outer circle reflects the totality of university students' use of social media, for the purposes of leisure and learning. Chu (2020) observed that within this totality, students used social media in the domain of everyday life, followed by informal learning and then formal learning. Students were not engaged in the activities described in the five claims of social media in informal and formal learning as much as they do in everyday life. This observation will be discussed further to identify ways of using students' current social media practices in a formal education setting.

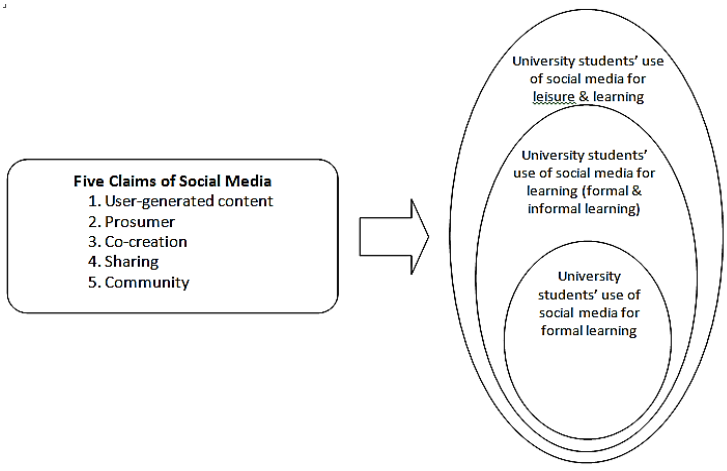

Figure 1: Conceptual framework of university students' social media use

Table 1: The five claims of using social media (Adapted from Chu, 2020)

Three major themes	Five claims	Major practices/activities involved	Tools/applications
User-generated content	User-generated content/creation	(1) Creating and producing media content for public forums	Social networking sites (e.g., Facebook, Twitter, Delicious, Instagram, LinkedIn, TikTok); Social file sharing tools (e.g., YouTube, Flickr, Snapchat); Co-writing tools (e.g., PBworks, Google Docs, Wikipedia); Blogs; RSS; Forums
	Prosumer	(1) Contributing to the creation of content, while simultaneously consuming it	Social networking sites (e.g., Facebook, Twitter, Delicious, Instagram, LinkedIn, TikTok); Social file sharing tools (e.g., YouTube, Flickr, Snapchat); Co-writing tools (e.g., PBworks, Google Docs, Wikipedia); Blogs; Forums
	Co-creation	(1) Co-producing a piece of work as part of a group	Social networking sites (e.g., Facebook, Twitter, Delicious, Instagram, LinkedIn); Co-writing tools (e.g., PBworks, Google Docs, Wikipedia); Blogs; Forums Microsoft Teams
Sharing		(1) Publishing, editing and sharing content (2) Commenting, blogging, instant messaging (3) Social tagging (4) Uploading and downloading content	Social networking sites (e.g., Facebook, Twitter, Delicious, Instagram, LinkedIn, TikTok); Social file sharing tools (e.g., YouTube, Flickr, Snapchat); Co-writing tools (e.g., Google Docs, Wikipedia); Blogs; Peer-to-Peer applications (e.g., BitTorrent, KaZaa); Instant messaging applications (e.g., WhatsApp, Skype, WeChat) Microsoft Teams
Community		(1) Socialising (2) Discussing (3) Mobilising crowds/communities for social movements (4) Mass collaboration	Social networking sites (e.g., Facebook, Twitter, Delicious, LinkedIn, Yammer, TikTok); Forums; Co-writing tools (e.g., PBworks, Google Docs, Wikipedia); Instant messaging applications (e.g., WhatsApp, Skype, WeChat) Microsoft Teams

Previous Pedagogies Adopted: Teacher-led and Student-led Approaches

For three years starting in 2007, a teacher-led approach was used to guide students to conduct their group projects on social media (Chu, 2020). This was shortly after social media, e.g., MySpace and Facebook, had gained global momentum in the mid-2000s (Boyd & Ellison, 2008). Most of the students weren't familiar with the tools available and how their features could support formal learning. Lecturers should become a role model in using social media actively and effectively if they expect students' active participation in incorporating social media (Kara et al., 2020). The teacher-led approach worked well as the lecturer was able to provide scaffolding support to students on his choice and ways of working on the social media platforms in a formal learning environment.

After three years of observations in using the teacher-led approach, the student-led approach was implemented (Chu, 2020). Students entering university in the early 2010s had more experience using social media, possibly from their daily lives. Based on their higher familiarity, some students wanted to apply their experience of using social media from everyday life to formal learning and were eager to select and try out alternative tools suggested by the lecturer. For example, some students preferred to use Google Docs, rather than the Wiki platform suggested by the lecturer. The author then realised that the students were ready to decide on which social media tool(s) to use in conducting their inquiry group projects and switched to the student-led approach. Students were then free to decide which social media tools to use, and how to customise the platform (e.g., lay out or organise pages/sections) to facilitate their collaborative process.

Participatory Design Approach

From observing the implementation of the student-led approach, the lecturer discovered some students were more experienced in using social media, and their experiences were applicable from their everyday use to formal learning. To harmonize the differences among students and maximize the effects of applying social media to formal learning, the lecturer adopted a participatory design approach.

A participatory design approach is a framework that highlights the active contributions of both designers and users when designing a product or infrastructure (Reich et al., 1996; Sanders et al., 2010). Here, the designer refers to the lecturer, and the users refer to the students. It is an essential design strategy for creating artifacts and experiences that reflect the voices of the population being designed for and with (Coenraad et al., 2019). The involvement of users in the design conceptualization phase is advantageous because designers and experts obtain immediate feedback from their target users on improving the features and content of a specific design (Reich et al., 1996; Davis et al., 2018).

The participatory design approach is a potential strategy to improve educational practices by optimizing collaboration between students, teachers, and designers, which is tantamount to developing an effective learning environment (Könings et al., 2014). This optimization can be explained by the fact that the purposes of social media activities for formal learning differs from everyday life (Chu, Zhang, et al., 2017). Students who can use social media in their daily lives skilfully would not automatically be proficient in using it for formal learning purposes. Thus, weighing the pros and cons of the two previous approaches used, the participatory design approach was adopted to develop an effective social media environment with one or more social media tools that continually examines students' needs. Students who conducted their inquiry group project under this approach had the autonomy to choose the social media tools they preferred and then adapted and/or developed it to suit their project's needs with the lecturer. Throughout adapting or developing the social media environment, the lecturer provided scaffolding support in training and resources.

There are five elements in the participatory design approach (Clement & Van den Besselar, 1993; Kensing, 1982), as outlined and identified (Albouys-Perrois et al., 2018; Kensing & Blomberg, 1998; Simonsen & Robertson, 2013):

1. Access to relevant information
2. Possibility of assuming independence in addressing problems
3. Contribution to decision-making
4. Appropriate development methods
5. Possibility of alternative technical and organizational conditions

LITERATURE REVIEW

USE OF SOCIAL MEDIA IN HIGHER EDUCATION GROUP PROJECT WORK

A bulk of studies examined social media's affordances in teaching and learning. The majority of literature in this category considered social media to be useful. A perception study examined how social media could be used to enhance collaboration and foster a sense of community among students (Chugh & Ruhi, 2018). Empirical studies showed that using social media helped improve students' academic performance in general regardless of the types of activity and by collaboration with their peers on social media (Al-rahmi et al., 2014; Chugh & Ruhi, 2018; Santoveña Casal, 2019; Talaue et al., 2018). Interestingly, Stathopoulou et al. (2019) discovered that students from higher education argued that social media could be particularly effective in reinforcing memory and accommodating learning styles that were associated with more visual elements in the class.

Some researchers have developed social media-assisted pedagogies and refined them over time: adopting a design-based research method. For example, Zheng et al. (2015) carried out their pedagogy, reflected on four iterations, and provided suggestions for educators to effectively implement collaborative activities on wikis. Also, they emphasised that a well-designed pedagogy is essential to the success of any technology-facilitated higher education learning activities. On that basis, Li and Chu (2018) developed a conceptual model of a wiki-based collaborative writing pedagogy using design-based research method, which provided a good example for utilising this method to design and develop pedagogies.

While there is no lack of case studies of using social media in higher education, there is a lack of consensus of a best practice or approach adopt social media in teaching and learning. University lecturers are, understandably, exploring how to approach social media's pedagogical integration best. The prevalence of social media in learning remains a relatively recent technology development, despite its ubiquity in students' everyday lives, it has not been considered for a learning medium by a growing number of educators until recent years. Hence, from the existing studies, a research gap has been observed on the best practice and effectiveness in adopting social media in higher education classroom level. Despite the technology's affordances in facilitating communication, its successful or effective use is influenced by various factors. Recent case studies were analysed by Ahmad and Jumaat (2016), which summarised factors influencing student's interaction on social media such as design and structure of the site, sense of belonging to the platform, pedagogical support available, course design, and students' readiness. Al-Qaysi et al. (2020) outlined that perceived enjoyment, subjective norm, self-efficacy, perceived playfulness, perceived critical mass, and openness were the most frequent factors that significantly influenced the social media adoption in higher education. Other studies found that there were nuances such as students' previous learning experience and technical backgrounds (Chu, Capio, et al., 2017), as well as education levels (Du et al., 2016). As such, educators are recommended to sufficiently prepare for the incorporation and design of social media-assisted pedagogy into higher education before its implementation (Chugh & Ruhi, 2018; Lai et al., 2012; Ohei, 2019; Tu et al., 2012). These studies display the need of an effective pedagogical framework for implementing social media into higher education formal learning context.

Jordan (2019) reviewed the best characterized benefit on how and why academic social network sites were used among educators was for dissemination of academic publications such as academia.edu and research gate. On an institutional level, the implementation of social media in higher education

remained a decision made by individual lecturers, rather than a systematic approach originating from decision makers at the institution (Sobaih et al., 2020; Tess, 2013). This is reflected by the number of relatively small-scaled case studies that have been published. Tinmaz (2012) pointed out that institutions often suffered from a deficiency of learning theories or frameworks to guide educators to effectively implement social media related pedagogies. While the use of social media in formal learning has garnered much interest among educators (Chen & Bryer, 2012; Hashim et al., 2018; Mpungose, 2020), the implementation of such pedagogies remains individually motivated rather than institution-wide (Sobaih et al., 2020; Tess, 2013). This reflects the need for educators spearheading the implementation of innovative pedagogies to promote them to fellow educators.

The studies above demonstrate the shortage of an effective pedagogical framework for implementing social media into higher education in formal learning context from the classroom and institution level.

THE CURRENT STUDY

The aim of this study was to propose a theoretical framework for scaffolding students' effective use of social media in formal learning using participatory design approach and outlines practical suggestions for lectures and institutions looking to implement this new pedagogy. Based on the research gap identified, the current study sets out to answer the research questions below:

RQ1: After gaining knowledge/experience with social media for education, what do students want to do with social media for informal and formal learning?

RQ2: To what extent do students find the participatory design approach effective for formal learning through co-creation in social media environments?

> RQ2.1: How were the students' experiences in using the participatory design method for social media platforms?
>
> RQ2.2: What were the students' views on adopting the participatory design method to co-create social media environments with their lecturer for formal learning?

METHODOLOGY

PARTICIPANTS

The research was conducted at a university in Hong Kong, students from two courses (Knowledge Management in the BSc in Information Management program, and Research Methods in the MSc in Library and Information Management program) were invited to participate. Since this research introduced an intervention in students' knowledge of social media, the researcher scheduled for two one-hour consultations with each group to review their project progress and offer guidance. As this measure demanded a considerable amount of time, it would have been difficult to involve lecturers and students in courses which the researcher was not personally involved in. Therefore, the researcher adopted the convenience sampling method and invited his students to participate in this research (Creswell & Guetterman, 2019).

The Knowledge Management course was delivered twice and the Research Methods course was delivered three times. All students received information and instruction on how social media can facilitate learning for the duration of the courses. However, only students who gave their informed consent after having been duly informed about the study's methods and implications were invited as the participants in the research.

Implementation of the Participatory Design Approach

For each of the five cohorts of participants, the lecturer for the two courses (i.e., the researcher) implemented a participatory design approach to co-create a social media environment for formal learning. At the beginning of their project, the students were invited to use one or more social media tools to complete the group project work for the course. Both the lecturer and the students played a significant role in creating a suitable social media environment. This stage specifically addresses RQ2. Students could choose Wiki, Google Doc, or other form of social media that facilitated co-writing.

The participatory design approach illustrates how students naturally work and learn with the wide range of social media tools. The students engaged in choosing a social media tool and designing the learning environment actively with the scaffolding support from their lecturer. In order for students to acquire a basic understanding of how social media tools could be used for learning, the lecturer conducted a brief introductory workshop session within the first three weeks of the course covering various social media tools. Students were required to read at least one journal article (out of the three articles provided by the lecturer) to be familiar with the latest studies. Then, the lecturer met each group of students twice for consultations on the project topic and the social media tools. During the consultations, the lecturer first facilitated negotiations toward a goal that was mutually agreed with the students to implement a formative assessment and provide feedback. Researchers could have an initial understanding on how students select the social media tool for their group projects. After the consultation, students decided which social media tool would work best for their projects. For both courses, groups of 3-5 students worked on their project work for about 2-2.5 months with a social media tool. The projects were a case study for the BSc Knowledge Management course and a critique on a Master's thesis for the MSc Research Methods course.

Four of the five requirements of the participatory design approach (Albouys-Perrois et al., 2018; Kensing & Blomberg, 1998; Simonsen & Robertson, 2013) were addressed through the different components of the course implementation (see elements 1–5 on Page 6). The fourth requirement was not evaluated as it was applicable to the participatory design of complex platforms. It was included in the first round of data collection but withdrawn for subsequent phases. Since the online social media platform developed by the students was rather simple and found that it was difficult to respond to this requirement in the individual interview conducted at the end of the course.

Data Collection

This study adopts a mixed-method approach by collecting quantitative and qualitative data using four research instruments: a questionnaire, a focus group interview, an individual interview, and students' self-reflection. Specifically, the four research instruments were used in addressing RQ1, and the individual interview was used in addressing RQ2.

All participants were asked to fill in the questionnaire (see Appendix A[1]). The questionnaire contained 9 questions designed to acquire an initial understanding of students' experience with social media in terms of the three domains – everyday life, formal and informal learning. The questions covered their usage frequency, familiarity, perceived benefits, and concerns of social media on the three domains from their experience during the coursework. The results were derived and contributed as a basis for focus group interviews and Q.12 – Q.19 in the individual interviews for RQ1.

Focus group interviews with cohorts of students were designed to develop an in-depth understanding of what students want to do with social media for the three domains (see Appendix B). There was a total of 8 questions. Questions 1 – 6 encored the focus on their experience from part A of the questionnaire that students were invited to share their experience with social media in informal and formal learning. For question 7 – 8, it synced with part B of the questionnaire, which focused on their purpose and perceived benefits of social media based on the five claims of using social media

[1] All appendices can be downloaded from https://doi.org/10.28945/4703

(UGC, prosumer, co-creation, sharing, and community). There was a total of 20 groups (7 from BSc studies and 13 from MSc studies), with 4–5 students in each group (see Table 2).

Table 2: Focused group interviews

Level of study	Cohort	Number of groups
BSc	First cohort	2
BSc	Second cohort	5
MSc	First cohort	2
MSc	Second cohort	6
MSc	Third cohort	5
	Total	20

Individual interviews were conducted over the phone at the end of the semester (see Appendix C). They gathered students' insights on designing, building, developing, testing, and refining their social media environments (see Table 3). It allowed researchers the capacity to obtain a comprehensive description of students' experience on participatory design approach of co-creating the social media learning environments. Students evaluated the usefulness of the social media environments for their inquiry group projects in Q.3 – Q.9 and Q.12 – Q.19, which contributed to RQ1. Q.1 – Q.4 addressed RQ2.1 on their experiences based on the four elements of the participatory design method. Q.10 and Q.11 projected students' views for RQ2.2 on adopting the participatory design method as if they were the lecturers in helping their students design a social media platform for a group project in higher education.

Table 3: Individual student interviews

Level of study	Cohort	Number of students
BSc	First cohort	4
BSc	Second cohort	11
MSc	First cohort	10
MSc	Second cohort	13
MSc	Third cohort	17
	Total	55

Students were expected to prepare a self-reflection after reading one of the three selected articles on social media (see Appendix D). They could express their experience and afterthoughts on social media usage in everyday life, informal and formal learning freely, and how they planned on incorporating social media into their group projects.

Data Analysis

Qualitative data was analysed using thematic analysis to help identify, extract, and organise the key themes and sub-themes. Thematic analysis allows researchers to describe the dataset in rich detail and interpret the various aspects of the research topic (Braun & Clarke, 2006, 2012). The researcher first familiarised himself with the data by transcribing, reading, and re-reading it while noting down ideas for themes. When thematically consistent passages were noted, initial codes were generated. The researcher then categorised the data by code, before collating these codes to form overarching themes. These themes were then checked for validity in relation to the extracted text in the initial codes and the entire dataset, resulting in a 'thematic map'. The finalised themes were then named and defined, so that their specifics could be related to the research questions and literature.

Thematic analysis was applied to transcripts of students' responses to the open-ended questions in the questionnaire, students' reflection exercises, focus group interviews, and individual interviews. These were analysed through axial coding with NVivo 9.0, leading to the development of themes.

The data for RQ2 was collected from five cohorts over a period of 1.5 years, to ensure intensive, long-term involvement (Maxwell, 2012) and data richness. Member checking was applied to eliminate bias (Creswell & Guetterman, 2019; Creswell & Miller, 2000; Lincoln & Guba, 1985; Yin, 2014). Discrepant evidence and negative cases were identified and analysed to examine the overall argument (Maxwell, 2012). Quantitative results were triangulated with qualitative results (Maxwell, 2012). Data reliability for RQ2 was ensured by having 2 experienced NViVo users to code transcripts. The first coder analysed and coded 100% of the data and devised a complete coding scheme (see Appendix E) for the project. The second coder was assigned to code 20% of the data. Good inter-rater reliability was established as the two raters displayed over 80% agreement of ratings (Miles & Huberman, 1994; Miles et al., 2020).

RESULTS

The results are presented in two main sections according to the two research questions.

STUDENTS' USE OF SOCIAL MEDIA FOR LEARNING

Table 4 shows the formal learning activities by the number of BSc and MSc students who wanted to perform with social media tools after gaining knowledge and experience. The data was extracted from the questionnaire's fundamental understanding and their description from the focus group and individual interviews. If there were any social media tools they had used before (not for learning purposes), the students were asked if those tools had the potential for formal learning.

Table 4: Activities students want to use social media in formal learning

Domain	Activity	Social Media Tool	Number of BSc students (n=33)	Number of MSc students (n=53)
Formal learning	Collaboration and communication in group projects ("Group projects")	Facebook	2 (6%)	4 (8%)
		Google Docs	2 (6%)	5 (9%)
		Skype	1 (3%)	1 (2%)
		WhatsApp	2 (6%)	2 (4%)
		Wiki	2 (6%)	2 (4%)
		WeChat	0 (0%)	2 (4%)
		Forum	0 (0%)	2 (4%)
		Subtotal	9 (27%)	18 (34%)
	Gaining knowledge	Wiki	4 (12%)	5 (9%)
		Blog	1 (3%)	1 (2%)
		Facebook	0 (0%)	1 (2%)
		YouTube	7 (21%)	2 (4%)
		Forum	3 (9%)	1 (2%)
		Google Docs	1 (3%)	1 (2%)
		Subtotal	16 (48%)	11 (21%)
	Content sharing	Facebook	2 (6%)	1 (2%)
		Forum	0 (0%)	1 (2%)
		Google Docs	0 (0%)	3 (6%)
		YouTube	1 (3%)	0 (0%)
		Skype	1 (3%)	0 (0%)
		WhatsApp	1 (3%)	0 (0%)
		Subtotal	4 (12%)	5 (21%)

The results show that students wanted to use more social media tools for "group projects" and "gain knowledge" activities in formal learning. These two activities received 27 counts each in total. In particular, 16 of the BSc students (48%) wanted to gain academic knowledge mainly through YouTube, stating, for example, "YouTube will be a good choice for (audio-visual versions of) articles or journals" (BSc-Cohort 1-TMaM). In this quote from the focus group interviews, the student referred to the pool of videos explaining theoretical concepts uploaded by YouTube users. In another interview, a student reported that videos demonstrating how to solve a complex math problem were helpful in walking him through the steps of calculations (BSc-Cohort 2-DHKJ). With YouTube's multimedia platform, students found the combination of text, visuals, graphics, and audio attractive, and these elements helped them learn more effectively. Hence, YouTube was often a source of knowledge in the domain of formal learning. While the platform supports both dissemination and consumption of videos, as well as interaction among users in the comments section, students mostly reported using it as consumers, i.e., watching videos. Students using YouTube for formal learning limited their use to watching informative videos to enrich their knowledge on a topic, rather than participating in the community by disseminating their own knowledge. One of the cases was different, in which a student produced a video for a media course and learnt how to tailor the video's content to boost the number of "likes", an important metric of audience engagement in social media (BSc-Cohort 1-KAICS). This example differed from the students' use pattern for YouTube, as the course focused on media that enabled students to both produce and consume in social media interaction.

Students tended to be more active prosumers on other social media tools and were more interested in sharing and co-creating on tools such as Google Docs and Facebook. Eighteen of the MSc students (34%) wanted to enhance group project communication mainly through Google Docs and Facebook, for instance stating "I think (Facebook) can be used for formal learning. For example, opening a Facebook group for group projects which I can keep it private or open. I can comment or upload pictures if I am a member of that particular group" (MSc-Cohort 1-AH). The MSc students found Google Docs and Wiki to have the highest potential. Most students interviewed reported having used Google Docs to share both informal and formal learning materials when conducting group projects (MSc 14-1 WSA). In addition, some students reported having used it for document exchange (BSIM 14-4 DHKJ). Google Docs was chosen for file sharing as students recognised its ability to help disseminate information quickly (BSIM 14-4 DHKJ). They used it as a platform to gather information when working on group projects (BSIM 14-4 GKH). Students would even use Google Docs during lectures (MSc 14-1WSA). This could be because the tool supports real time co-editing, which was useful for students wanting to quickly take notes in lectures and consolidate each contributor's notes into one single document.

The students recognised the importance of sharing in the co-creation of knowledge. A preference for "learning in groups" was observed in the interviews. One student pointed out that sharing content is useful because knowledge is only available in one's mind until expressed to others, only then does it become shared knowledge within a community (BSIM 14-4 DHKJ; MSc 13-3 P). Google Docs facilitates knowledge sharing, which in turn promotes brainstorming, as information contributed by one group member may inspire insight and opinions from others (BSIM 14-4 GKH). This is especially useful when there is a wealth of expertise on different areas from individuals within the group (BSIM 14-4 DHKJ).

Another consideration for adopting a social media platform was its ability to support later collaboration. The students found the version history record in Google Docs useful (MSc 13-6 An). This function was helpful for reviewing their written projects, as it clearly showed each group member's contribution and enabled them to access older documents if they needed to revert to a previous version.

While the students praised social media's affordances for sharing and co-creation, they also commented on its shortcomings. Some students experienced technical issues where a platform would only support certain file formats and caused inconvenience (MSc 14-1 WSA). For the same reason,

students deemed tools like Skype or WhatsApp not useful for sharing or co-creation. Although both programs support file sharing, students categorised them as instant communication tools and did not find them user-friendly for document sharing (BSc 14-4 DHKJ).

Cultural-political factors also played a role in the students' choice of social media for sharing and co-creation in formal learning. In the group projects, certain groups were comprised of local (Hong Kong) students and students from mainland China. When students went back to mainland China during the project period, they had difficulty accessing platforms banned such as Facebook, and found them not useful for co-creation (MSc 14-4 MX). This hindered communication.

The above anecdotes reinforced the finding that students were able to recognise the affordances and limitations of each social media platform and could find the appropriate tools for their learning activities. This correlation suggested that students were more motivated to use social media that they perceive it as useful for a certain purpose. This created significant pedagogical implications for lecturers who intend to incorporate social media in their curriculums – it is imperative that lecturers and students reach a consensus about which social media tool and how they will utilise the tool in education.

Participatory Design Approach's Effectiveness of Social Media for Learning

This section was split into the following two sub-sections according to the two sub-questions.

Students' experiences on co-creating social media environments with their lecturer in participatory design approach

During the individual interviews with the students, the researcher asked questions about their experience, focusing on the four elements of the participatory design approach (Albouys-Perrois et al., 2018; Kensing & Blomberg, 1998; Simonsen & Robertson, 2013). Table 5 contains the descriptive data from the students' views on their experience using the participatory design method to co-create an online social media platform conducive to their group project work.

Table 5: Students' experiences using the participatory design method to co-create a social media environment conducive to formal learning

Number of BSc and MSc students (n=52)	Strongly disagree < ---------- > Strongly agree 1	2	3	4	5	Mean	SD
1. I had sufficient access to relevant information (e.g., articles, an introductory workshop) about applying social media in formal learning.	0 (0%)	4 (7.1%)	11 (19.6%)	30 (53.6%)	11 (19.6%)	3.86	0.82
2. I felt that I had autonomy/independence in solving problems related to the social media platform design.	0 (0%)	5 (8.9%)	9 (16.1%)	37 (66.1%)	5 (8.9%)	3.75	0.74
3. I contributed to the decision-making process regarding which social media tool to employ for the group project.	2 (3.6%)	2 (3.6%)	8 (14.3%)	29 (51.8%)	15 (26.8%)	3.95	0.94
4. I had the opportunity to decide to change my group's social media platform when needed.	3 (5.4%)	1 (1.8%)	13 (23.2%)	29 (51.8%)	10 (17.9%)	3.75	0.96

The students had a positive experience based on the four elements of the participatory design method. One of their significant considerations was convenience, e.g., whether they need to tweak the platform's layout or switch to another platform.

Regarding the access to information, the students were satisfied that they had access to the relevant information to conduct formal learning activities on social media. A major source of information was the lecturer's introduction to various social media platforms. Several students expressed that they found it useful to learn how they could make use of different social media platforms from the lecturer's demonstration (MSc 13-1 CKHC KHAC; MSc 14-1 WSA). They considered this as a reliable and authoritative source of information. Regardless of their prior experience in using other social media platforms, they would adopt the platforms recommended by the lecturer (MSc 13-1 CKHC KHAC). Their second source of information was peers. Students with past experience using a particular social media platform would share their knowledge with their peers during class (BSc 14-6 DCYT). The third source of information was the guidelines available online, either uploaded by the lecturer (e.g., the Moodle, a learning management system) or compiled by the developers (e.g., the Google Docs help page). Students did not consider these extra materials as a necessity to read thoroughly. But they were helpful when they encountered a specific situation and required assistance (BSc 13-1 KKLK). From the same instrument, Table 6 shows the students' evaluation of "sufficient access to relevant information" and "autonomy in solving problems" across different social media platforms.

Table 6: Students' evaluation of "sufficient access to relevant information" and "autonomy in solving problems"

Elements of participatory design		**BSc (n=15)**	**MSc (n=37)**
1. Sufficient access to relevant information			
Information about	**Source**		
Google	Course	3	2
Wiki	Course	5	11
Social media in general	Course	3	14
	Self-learning	2	2
Others	Course	0	4
YouTube	Course	0	3
Forum Blogs	Course Self-learning	1 0	0 1
	Subtotal	**14**	**37**
2. Autonomy in solving problems			
Problems with	**Social media tool**		
Making comments	Google	1	0
	PBworks	0	1
Tracing revision history	Google	1	0
Granting access	Google	0	3
Looking for keywords	Wiki	0	1
Information management and retrieval		0	1
Receiving RSS	PBworks	0	1
Finding solutions with others	Teammates	2	4
Finding solutions alone	Forum	1 4	1 3
	Subtotal	**10**	**23**

14 out of the 15 BSc students and all of the MSc students agreed that they had "sufficient access to relevant information". 3 of the BSc and 14 of the MSc students mentioned that they had obtained relevant information about "social media in general" and various social media tools from the course

and self-learning. For instance, one student responded, "The lecturer provided some materials during the course. And I obtained information on PBworks, the tool that my group used for building our collaborating platform" (MSc 13-6 LHW).

Regarding autonomy, the students perceived that they had autonomy to choose their preferred social media tool. The majority (10 of the 15 BSc students and 23 of the 37 MSc students) agreed that they had autonomy in solving problems. One of the groups shared how they encountered some problems with RSS. They were able to solve the problem independently and indicated that "we went onto Google and searched how to deal with the problem, and we were able to solve it" (MSc 13-6 KHT). However, one of the students shared that some of their peers lacked the initiative to explore different options and preferred reaching a consensus to use the tools recommended by the lecturer conveniently (MSc 13-1 CKHC KHAC). This mindset carried through when they decided on the layout for their platform, they were not motivated to brainstorm any new methods or designs.

Table 7 shows the students' evaluations of "contributing to the decision-making process". Students were asked whether they contributed to their group's decision-making about the social media tool for their project during the individual interview.

Table 7: Students' experiences of "contributing to decision-making" and "deciding to change"

Elements of participatory design	BSc (n=15)	MSc (n=37)
3. Contributing to decision-making		
Comparing pros and cons	3	4
Group discussion/negotiation	5	17
Guidelines from class	0	4
Choosing social media tool/s that favor collaboration	5	2
Individual decision-making	1	7
Subtotal	**14**	**34**
4. Opportunity leading to the decision to change		
Layout changed in Google Docs	1	1
Tool changed from Google Docs to PBworks	0	1
Group decided	3	16
Student could decide individually	0	3
Subtotal	**4**	**21**

A great majority (14 out of 15 BSc and 34 out of 37 MSc students) agreed that they had contributed to the decision-making process. Most of the decisions regarding the social media tool for the students' projects (5 BSc projects and 17 MSc projects) were made through group discussions and negotiations. For example, one of the students shared their decision-making process. Each group member came up with alternatives of the social media tools and rated each tool. They picked PBworks for their project eventually (MSc 13-6 CYL). They agreed that the lecturer made it clear that students were free to adopt their choice (MSc 13-1 CHKC KHAC), and that they played a major role in designing the platform's layout (BSc 13-1 MKY). One of the students acknowledged that they were "not very professional" in using social media, and the training provided by the lecturer enabled them to "finish the project and use the tools independently" (MSc 13-1 KL).

Students were asked whether they had the opportunity to switch to another social media platform during the project period. There were some mixed responses. One of the students reflected that the group did not change their platform over the course of the project. He felt that his group members preferred to use the easiest and most straightforward platform. He would be open to changes if the proposed changes could improve their collaboration (MSc 13-1 CKHC KHAC). Another student reflected a critical point of view that several members of the group noticed some shortcomings of the current social media tool. However, they continued to use the same tool without any changes because

most of the group members thought that they had worked out a smooth collaboration process and opposed changes (MSc 13-1 CKHC KHAC). These comments reflected the students' emphasis on "convenience", or the ease of collaboration. They were conscious that the social media tools might not be perfect in terms of functionality. However, if the shortcomings were tolerable, they preferred to collaborate on the current tool rather than starting fresh.

As students preferred a smooth process and the ease of working together, the lecturer's role in introducing students to various social media platforms could be influential during their selection. Lecturers should keep themselves up to date on the latest developments of the social media tools available, so they are able to advise which tools may best suit students' learning activities. Otherwise, given students' reliance on information provided by their lecturers, they may make their decisions based on outdated information and miss the opportunities to use the latest technology.

Students' views on co-creating social media environments with their lecturer in participatory design approach

Table 8 and Table 9 shows the students' rating and their responses respectively on their experience using the participatory design method as if they were the lecturer. The data was extracted from Q.10 of the individual interviews. The results were positive (with an average rating of 3.79 out of 5).

Table 8: Students' ratings on using the participatory design method to co-create a social media environment conducive to formal learning as if they were the lecturer

BSc and MSc (n =52)	Strongly disagree < ---------- > Strongly agree					Mean	SD
	1	2	3	4	5		
If I were the lecturer, I would implement this participatory design method to help my students design the social media platform for their group project	0	7	8	26	14	3.79	0.95
	(0%)	(12.7%)	(14.5%)	(47.3%)	(25.5%)		

Table 9: Students' responses to the statement, "If I were the lecturer, I would implement this participatory design method to help my students design the social media platform for their group project"

	BSc (n=15)				MSc (n=37)			
Reason	Yes (n, %)		No (n, %)		Yes (n, %)		No (n, %)	
Give guidance to students	4	(25.0%)	1	(6.3%)	6	(15.8%)	2	(5.3%)
Ensure progress	4	(25.0%)	0	(0.0%)	6	(15.8%)	1	(2.6%)
Respect students' needs	4	(25.0%)	1	(6.3%)	7	(18.4%)	3	(7.9%)
Other	2	(12.5%)	0	(0.0%)	13	(34.2%)	0	(0.0%)
Subtotal	14		2		32		6	

A common positive response from the students was that they could receive guidance and feedback from the lecturer. They agreed that the lecturer's support was useful. One of the students said, "Students can get a clearer direction when they are working on the project because of the lecturer's support" (MSc 13-6 MWOC). Students expressed that they preferred different channels to receive the lecturer's feedback during the interview. Some students valued the lecturer's input in the face-to-face consultation sessions more (BSc 14-6 IHKH), as the verbal exchange allowed them to follow up on

questions and receive extensive advice or feedback immediately. Other students preferred the online comments written by the lecturer on the social media tool, as they were able to receive feedback without going through the time-consuming process of scheduling a consultation session between the group and the lecturer (BSc 14-6 DCYT).

Also, students recognised the value of giving the lecturer access to their social media platform. It allowed the lecturer to see their progress and intervene when necessary (e.g., when they were off-topic) (BSc 13-1 MKY). This reflected that although "ensuring progress" was one of the reasons that the students supported implementing participatory design, they did not expect the lecturer to drive them to do work. Instead, they trusted the lecturer to act as a gatekeeper who would prevent them from taking the wrong path.

A similar response that the students supported the participatory design approach is the respect for students' needs. Students recognised that the purpose of adopting this method was to empower them to decide how they would learn (i.e., collaborate on a project), but it also allows the lecturer to offer guidance along the way. One of the students mentioned that they preferred this pedagogical method because "it lets the student choose, make their own decision and let [the lecturer] check last" (MSc 13-1 YL). Another student believed that the participatory design process gave the students a chance to self-reflect. The self-reflection enabled them to clarify their understanding of concepts and find out their learning needs (MSc 13-6 LYC). This was in line with another student's response that the process made them "think about which social media tool design is the most suitable for [their] own project" (MSc14-1 YYZ).

While most of the students were positive about the implementation of a participatory designed social media tool, one of the students was against the requirement of using a social media tool in a course. He believed that the tool would not be effective unless they were self-motivated to incorporate into their projects. "If students are forced to use a social media tool, they will not use it again after the course. I think it would be more desirable to introduce the tools during lessons. The lecturer can share some links with the students and let them decide which tool they would like to use [if any]" (MSc 13-6 KHT).

The findings of this section show that the students rated the participatory design method favourably. Their responses reflected that the approach balanced their needs for training and freedom to navigate through the tools and the collaboration process appropriately. The participatory design method combined the strengths of the two other methods tested by the researcher in earlier trails (teacher-led and student-led) and was positively received as a result.

DISCUSSION

This section highlights the major contributions of this research. The study results are analysed further to support the development of the theoretical concept and to make practical suggestions to enhance the pedagogy.

THEORETICAL FRAMEWORK

Numerous case studies proved that social media is beneficial in higher education in many aspects, this study confirmed the coherent positive influence of social media in high education group projects. However, when adopting social media in higher education teaching and learning, there is a lack of consensus of a best practice or approach. The ultimate goal of this study is to enhance students' use of social media tools for better and more effective formal learning.

The participatory design approach offers students a two-fold scaffolding support, firstly from their own experience (the rectangle in the bottom left of Figure 2), and secondly – and equally importantly – from their teacher's expertise (the rectangle on the right of Figure 2). Students have been using social media in their everyday lives, and their experience and knowledge obtained in everyday use led to their use in the informal learning domain. Students have the potential to transfer their experience and

knowledge from using social media at home to school, which is working towards the formal learning domain (Potter, 2011). At the same time, teachers contribute to their students' ability to incorporate social media tools into their formal learning through various practices. They provide information sources such as articles for reference and information at the beginning of the projects. Teachers provide a certain level of training on social media tools to their students, and specific scaffolding support, such as initiating face-to-face group consultations with their students. The input from the students and teachers will heighten students' perceived usefulness and familiarity with social media tools, and in turn empower them to effectively make use of social media for formal learning (Chu, 2008).

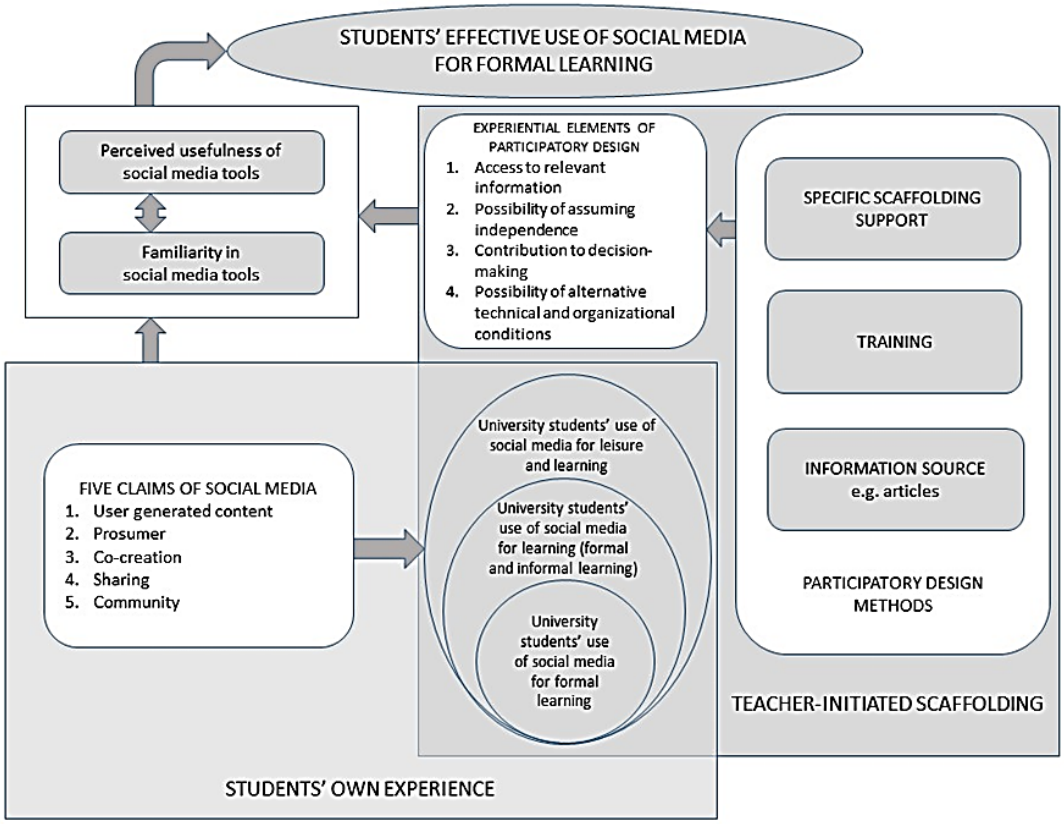

Figure 2: Theoretical framework of scaffolding in participatory design methods for students' effective use of social media in formal learning

From this study, students responded positively and recognised the value from the interaction with the lecturer by the participatory design approach. Based on the findings, this study proposes a theoretical framework outlining the use of scaffolding processes in participatory design approach. The framework posits that the participatory design approach enables students to build the teacher's input with their past experience and knowledge into their effective use of social media in formal learning. In this framework we assume that, given the scaffolding support offered under the participatory design approach, students will experience the four elements of the participatory design platform put forward by Kensing (1982) and Clement and Van den Besselar (1993), and identified by Kensing and Blomberg (1998), Simonsen and Robertson (2013) and Albouys-Perrois et al. (2018). The results showed that the majority of the students experienced these four elements when they used the social media tools for formal learning, therefore, the findings support the initial assumption.

We have established that the process is empirically feasible, and that there is potential for students and lecturers to co-construct the learning experience under the participatory design approach from this study. It is essential to establish that this approach is effective for learning. The interviews with the students revealed that they enjoyed autonomy in learning while appreciating their lecturer's advice

to a certain degree, especially in the early stage of the project when they had to decide which social media tool to work on. This theoretical framework factored in students' learning preferences, allowed sufficient room for exploration and ensured that they received guidance along the progress from their lecturer. The lecturer may tailor his advice to scaffold individual students' learning outcomes without hindering students' autonomy based on their capability. The pedagogy is concurrent with some of the best practices in teaching and learning. For example, the use of wikis in group project writing encourages "less student passivity and more active, collaborative learning", while the use of the participatory design approach enables the use of "less one-size-fits-all approaches to learning and more differentiated approaches to instruction to meet the needs of individuals" (Zemelman et al., 2012).

Pedagogical Aspect

This section explains how the theoretical framework can be applied to enhance the pedagogy.

Over the years, three approaches have been applied to create a social media environment for formal learning: teacher-led, student-led, and participatory design approach. The problem with the teacher-led approach was that some students were familiar with some social media tools and did not enjoy using the tool selected for their project by the lecturer. The student-led approach's problem was students' lack of understanding and experience in incorporating social media into formal learning prevented them from using social media in general or some social media tools for their group projects. Alternatively, with the participatory design approach, the lecturer provided some information such as articles for students to learn about the usefulness of social media for formal learning. They provided basic training on using social media during lessons and commented on the students' social media design for their group work during consultations. Meanwhile, the students took the responsibility of deciding which social media tool to use and designing the tool in a way that best suited their needs. For structuring courses at both Bachelor and Master's level, the participatory design approach seems to be the best approach of the three, as confirmed by the results of this study.

The study results have demonstrated how the participatory design approach could help students select the social media tools they would like to incorporate into their formal learning activities. When the students evaluated their engagement with the four experiential elements that constitute the participatory design approach, the majority of the students agreed that they were able to practise autonomy in solving problems, which implies that applying social media tools in formal learning could be beneficial for academic self-efficacy. It may lead to better learning outcomes. As such, it is crucial for teachers and lecturers to make good use of social media in assigning group projects and various tasks in the course. This practice is not limited to tertiary education, as technology and the Internet are in widespread use in secondary schools, social media and the participatory design approach employed in this research can be relevant for secondary school education.

Perspective on Social Media Benefits from Students in Different Education Levels

Previous studies proved that social media is beneficial for students' performances in improving students' academic performance by collaborations and effective in reinforcing memory and accommodating learning styles (Talaue et al., 2018; Santoveña Casal, 2019; Stathopoulou et al., 2019). This study examined social media's benefits for formal learning from the students' perspective after gaining knowledge and experience of using social media across various tools and their education programs. For bachelor's degree students, the most popular activity is to gain knowledge by YouTube. Surprisingly, as a well-known social tool, Facebook is the least preferred social media tool for this activity. The least popular activity for bachelor's degree students is content sharing through forums and Google Docs. On the contrary, the most favoured tool for Master's degree students in content sharing activities is Google Docs. It is first-ranked for collaboration and communication in group projects. The results showed the difference in selecting a social media tool for the same formal learning

activity across two education levels. There is a potential that multifunctionality can be one of the reasons students favoured a social media tool for formal learning. Further studies are recommended to examine the students' preference for the social media tool in higher education.

Recommendations for Educational Practice

This study found that students generally perceived the application of social media tools in formal education to be positive and useful, and showed the value of incorporating social media in formal university education and practice. To incorporate social media in education, the ultimate goal is to enhance students' use of social media tools for better and more effective learning. While there are individual lecturers who are willing and motivated to invest time and effort initiating and finessing social media related pedagogies, organisational change will be needed for the majority of lecturers to adopt these new pedagogies (Du et al., 2016).

Our study recommends initiating an organizational change at universities to adopt social media to formal education. It can provide adequate support for lecturers to utilise social media as one of the teaching tools on a massive scale. To students, it creates the space for their autonomy to enjoy the positive influence by social media in teaching and learning. The process of organisational change is summarised in three steps (see Figure 3). The first step is a structural change in university policies such as performance evaluation and/or new teaching-related funds. In the first step, university or faculty-level measures can be taken to help students fully utilise social media tools in educational contexts, by providing the necessary conditions and incentives. For example, the university may add an item in staff performance appraisals where students can evaluate lecturers' innovations in teaching. Incentives may be provided to encourage lecturers to apply social media tools, for example, allocating funding or time off for staff development training, and hiring part-time lecturers or assistants to cover the lecturers' teaching duties while they focus on researching/testing innovative pedagogies. With sufficient structural change, step two will occur: lecturers will feel motivated to incorporate social media in their teaching practice. The pedagogy can be refined to match students' levels of social media proficiency and their learning expectations. As the early adopters begin to see the success in their innovative pedagogies, it can encourage their fellow educators. At this stage, the institution will experience the third and final step in the organisational change process: a cultural change brought about by the diffusion of innovative pedagogies.

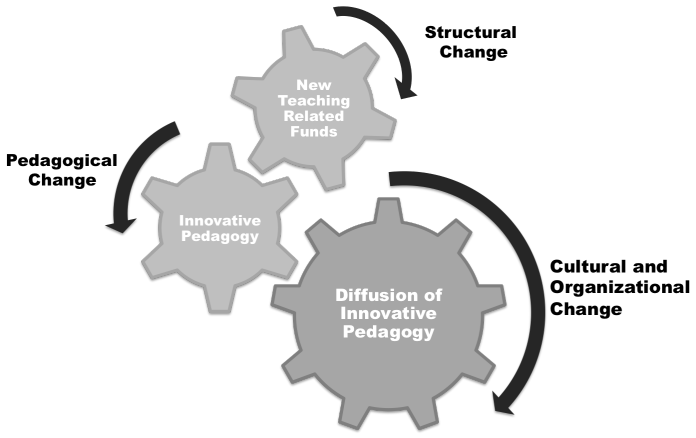

Figure 3: The process of organisational change to promote social media use in higher education (adapted from Chu & Mok, 2016)

The success of this process depends on both the university policy-makers and lecturers. With social media platforms surge and plummet, subscribing and sustaining membership for social platforms is costly for faculty members. Therefore, it is important for institutions to develop or subscribe their platforms at an institutional level and provide professional development programmes for faculty members (Kara et al., 2020). Management support from university policy-makers is important, as it

plays a key role in bringing the top-down structural change that encourages staff to adopt new pedagogies. Some lecturers working on the front line of teaching and learning will initiate pedagogical innovation, and others will keep an open mind to try new pedagogies. The former is essential in promoting top-down structural change as an early adopter, while the latter is integral to the adoption of new pedagogies and eventual cultural change after seeing the success. The present study may act as a primer to initiate organisational change in universities. It proposes and tests the social media pedagogy implemented in group projects using the participatory design approach and demonstrates the pedagogy's positive influence in teaching and learning. The researcher will use the results of this study to persuade university policy-makers to promote the new pedagogy, in the hope of spreading this type of practice and improving teaching and learning where group projects are concerned.

CONCLUSIONS

To investigate how university students might make the best use of social media as part of their formal university education, a mixed-method research was conducted to investigate students' preferences and effectiveness of participatory design approach for using social media in formal learning. Results show that students preferred to use social media to gain knowledge, collaborate and communicate with each other. Furthermore, we examined how the participatory design approach contributed to helping the students to co-create a social media environment in the formal learning domain with their lecturer. In general, the students appreciated the autonomy inherent in the use of social media to co-create a formal learning environment, and embraced the implementation of the participatory design approach, which offered them a greater sense of participation and ownership. The students appreciated the lecturer's support that helped to address their needs and they could self-monitor their work in formal learning.

This study builds on the findings in the study by Chu, Zhang et al. (2017) that students are more engaged in social media activities in their everyday lives, and less in informal learning and formal learning context. Some students are confident in social media's usage in general, they rely at least partially on their lecturer's guidance in adopting social media to the specific domain of formal learning. Taking note of the students' behaviour, this study translated this observation into theoretical and pedagogical implications for higher education. Compared to the student-led and teacher-led approaches, the participatory design approach enables the lecturer to offer the necessary scaffolding support without compromising students' autonomy. This approach is concurrent with the best practices in teaching and learning outlined in Zemelman et al. (2012).

Moreover, this study recognises that some lecturers' challenge of stepping out of their comfort zones in incorporating social media in teaching. To facilitate this change, university management can offer initiatives such as funding opportunities to support pedagogical innovations, including teaching and learning innovations in lecturers' annual performance assessments (Du et al., 2016). It is imperative that lecturers realise and become familiar with the potential of social media, for the effective integration of social media into formal education.

LIMITATIONS AND FUTURE RESEARCH

From this study, one of the limitations was a potential that multiple factors interfered with students' choice and experience of social media tools in formal learning apart from the lecturer's guidance that lacks further exploration, as the study focuses on their perceptions and experience in the participatory design approach. In the future, researchers could consider cognitive, psychological, and social factors on integrating social media into formal learning by in-depth interviews and case studies. Another limitation was the feasibility of the theoretical framework across different education levels, researchers could investigate the potential of the theoretical framework with participatory design in different education levels, e.g., secondary school education. It is worth examining if the autonomy that the students experienced will lead to better learning outcomes. Moreover, with the rapid development

of social media, further studies are worthy to examine the longitudinal impact of the current social media tools from this study or some new tools in the future.

REFERENCES

Ahmad, N. B., & Jumaat, N. F. B. (2016, May). Critical success factors to improve interactions in online social learning environment. In *Proceedings of the 4th International Conference on Information and Communication Technology (ICoICT)* (pp. 1-5). Bandung, Indonesia: IEEE. https://doi.org/10.1109/ICoICT.2016.7571897

Ahmed, Y. A., Ahmad, M. N., Ahmad, N., & Zakaria, N. H. (2019). Social media for knowledge-sharing: A systematic literature review. *Telematics and Informatics*, *37*, 72-112. https://doi.org/10.1016/j.tele.2018.01.015

Al-Qaysi, N., Mohamad-Nordin, N., & Al-Emran, M. (2020). Factors affecting the adoption of social media in higher education: A systematic review of the technology acceptance model. In M. Al-Emran, K. Shaalan, & A. Hassanien (Eds.), *Recent advances in intelligent systems and smart applications. Studies in systems, decision and control, volume 295* (pp. 571-584). Springer, Cham. https://doi.org/10.1007/978-3-030-47411-9_31

Al-rahmi, W. M., Othman, M. S., & Musa, M. A. (2014). The improvement of students' academic performance by using social media through collaborative learning in Malaysian higher education. *Asian Social Science*, *10*(8), 210-221. https://doi.org/10.5539/ass.v10n8p210

Albouys-Perrois, J., Laviole, J., Briant, C., & Brock, A. (2018, April). Towards a multisensory augmented reality map for blind and low vision people: A participatory design approach. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI'18)* (pp. 1-14). Montreal, Canada: ACM. https://doi.org/10.1145/3173574.3174203

Ayeh, J. K., Au, N., & Law, R. (2013). "Do we believe in Tripadvisor?" Examining credibility perceptions and online travellers' attitude toward using user-generated content. *Journal of Travel Research*, *52*(4), 437-452. https://doi.org/10.1177/0047287512475217

Boyd, D. M., & Ellison, N. B. (2008). Social network sites: Definition, history and scholarship. *Journal of Computer-Mediated Communication*, *13*(1), 210-230. https://doi.org/10.1111/j.1083-6101.2007.00393.x

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbooks in psychology®. APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological* (pp. 57–71). American Psychological Association. https://doi.org/10.1037/13620-004

Chen, B., & Bryer, T. (2012). Investigating instructional strategies for using social media in formal and informal learning. *The International Review of Research in Open and Distributed Learning*, *13*(1), 87-104. https://doi.org/10.19173/irrodl.v13i1.1027

Chu, S. K. W. (2008). TWiki for knowledge building and management. *Online Information Review*, *32*(6), 745-758. https://doi.org/10.1108/14684520810923917

Chu, S. K. W. (2020). *Social media tools in experiential internship learning*. Springer Nature. https://doi.org/10.1007/978-981-15-1560-6

Chu, S. K. W., Capio, C. M., van Aalst, J. C. W., & Cheng, E. W. L. (2017). Evaluating the use of a social media tool for collaborative group writing of secondary school students in Hong Kong. *Computers & Education*, *110*, 170-180. https://doi.org/10.1016/j.compedu.2017.03.006

Chu, S. K. W., & Mok, S. W. S. (2016). Changing organizational structure and culture to enhance teaching and learning: Cases in a university in Hong Kong. In L. Liudvika, & U. Wilkesmann (Eds.), *Organizing academic work in higher education: Teaching, Learning, and Identities* (pp. 186-202). Routledge.

Chu, S. K. W., Siu, F. L. C., Liang, M., Capio, C. M., & Wu, W. W. Y. (2013). Users' experiences and perceptions on using two wiki platforms for collaborative learning and knowledge management. *Online Information Review*, *37*(2), 304–325. https://doi.org/10.1108/OIR-03-2011-0043

Chu, S. K. W., Zhang, Y., Chen, K., Chan, C. K., Lee, C. W. Y., Zou, E., & Lau, W. (2017). The effectiveness of wikis for project-based learning in different disciplines in higher education. *The Internet and Higher Education*, *33*, 49-60. https://doi.org/10.1016/j.iheduc.2017.01.005

Chugh, R., & Ruhi, U. (2018). Social media in higher education: A literature review of Facebook. *Education and Information Technologies*, *23*(2), 605-616. https://doi.org/10.1007/s10639-017-9621-2

Clement, A., & Van den Besselaar, P. (1993). A retrospective look at PD projects. *Communications of the ACM*, *36*(6), 29-37. https://doi.org/10.1145/153571.163264

Coenraad, M., Palmer, J., Franklin, D., & Weintrop, D. (2019, June). Enacting identities: Participatory design as a context for youth to reflect, project, and apply their emerging identities. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children (IDC'19)* (pp. 185-196). Boise, USA: ACM. https://doi.org/10.1145/3311927.3323148

Creswell, J. W., & Guetterman, T. C. (2019). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson.

Creswell, J. W., & Miller, D. L. (2000). Getting good qualitative data to improve educational practice. *Theory into Practice*, *39*(3), 124-130. https://doi.org/10.1207/s15430421tip3903_2

Davis, S. R., Peters, D., Calvo, R. A., Sawyer, S. M., Foster, J. M., & Smith, L. (2018). "Kiss myAsthma": Using a participatory design approach to develop a self-management app with young people with asthma. *Journal of Asthma*, *55*(9), 1018-1027. https://doi.org/10.1080/02770903.2017.1388391

Dragseth, M. R. (2020). Building student engagement through social media. *Journal of Political Science Education*, *16*(2), 243-256. https://doi.org/10.1080/15512169.2018.1550421

Du, H., Chu, S. K. W., Chan, R. C. H., & He, W. (2016). Collaborative writing with wikis: An empirical investigation on group-based learning. *Online Information Review*, *40*(3), 380-399. https://doi.org/10.1108/OIR-06-2015-0173

García-Martín, J., & García-Sánchez, J. S. (2013). Patterns of Web 2.0 tool use among young Spanish people. *Computers & Education*, *67*, 105-120. https://doi.org/10.1016/j.compedu.2013.03.003

Gomez-Vasquez, L., & Romero-Hall, E. (2020). An exploration of a social media community: The case of #academictwitter. In *Social computing and social media: Participation, user experience, consumer experience, and applications of social computing (Lecture Notes in Computer Science)* (pp. 526-537). Springer. https://doi.org/10.1007/978-3-030-49576-3_38

Hashim, K. F., Rashid, A., & Atalla, S. (2018). Social media for teaching and learning within higher education institution: A bibliometric analysis of the literature (2008-2018). *International Journal of Interactive Mobile Technologies (iJIM)*, *12*(7), 4-19. https://doi.org/10.3991/ijim.v12i7.9634

Hemmi, A, Bayne, S., & Land, R. (2009). The appropriation and repurposing of social technologies in higher education. *Journal of Computer Assisted Learning*, *25*(1), 19-30. https://doi.org/10.1111/j.1365-2729.2008.00306.x

Ivala, E., & Gachago, D. (2012). Social media for enhancing student engagement: The use of Facebook and blogs at a University of Technology. *South African Journal for Higher Education (SAJHE)*, *26*(1), 152–167. https://doi.org/10.20853/26-1-156

Johnson, M., Mozaffar, H., Campagnolo, G. M., Hyysalo, S., Pollock, N., & Williams, R. (2014). The managed prosumer: Evolving knowledge strategies in the design of information infrastructures. *Information, Communication & Society*, *17*(7), 795-813. https://doi.org/10.1080/1369118X.2013.830635

Jordan, K. (2019). From social networks to publishing platforms: A review of the history and scholarship of academic social network sites. *Frontiers in Digital Humanities*, *6*, 5. https://doi.org/10.3389/fdigh.2019.00005

Kara, N., Çubukçuoğlu, B., & Elçi, A. (2020). Using social media to support teaching and learning in higher education: An analysis of personal narratives. *Research in Learning Technology*, *28*, 2410. https://doi.org/10.25304/rlt.v28.2410

Kensing, F. (1982, September). The trade unions influence on technological change. In U. Briefs, C. Ciborra, & L. Schneider (Eds.), *Proceedings of the IFIP WG 9.1 Working Conference on Systems Design for, with, and by the Users*. Riva del Sole, Italy: North-Holland Publishing Company.

Kensing, F., & Blomberg, J. (1998). Participatory design: Issues and concerns. *Computer Supported Cooperative Work (CSCW)*, *7*(3-4), 167-185. https://doi.org/10.1023/A:1008689307411

Könings K.D., Seidel, T., & van Merriënboer, J. J. G.. (2014). Participatory design of learning environments: Integrating perspectives of students, teachers, and designers. *Instructional Science, 42*(1), 1-9. https://doi.org/10.1007/s11251-013-9305-2

Lai, C., Wang, Q., & Lei, J. (2012). What factors predict undergraduate students' use of technology for learning? A case from Hong Kong. *Computers & Education*, *59*(2), 569-579. https://doi.org/10.1016/j.compedu.2012.03.006

Lam, S. S. K. (2019). Multi-layered identities by social media and prosumption practices in digital and participatory communication. *Journal of Digital Media & Interaction*, *2*(3), 7-22. https://proa.ua.pt/index.php/jdmi/article/download/3747/2889

Li, X., & Chu, S. K. W. (2018). Using design-based research methodology to develop a pedagogy for teaching and learning of Chinese writing with wiki among Chinese upper primary school students. *Computers & Education*, *126*, 359-375. https://doi.org/10.1016/j.compedu.2018.06.009

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Mao, J. (2014). Social media for learning: A mixed methods study on high school students' technology affordances and perspectives. *Computers in Human Behaviour*, *33*, 213-223. https://doi.org/10.1016/j.chb.2014.01.002

Martin, L., & Tapp, D. (2019). Teaching with teams: An introduction to teaching an undergraduate law module using Microsoft Teams. *Innovative Practice in Higher Education*, *3*(3), 58-66. http://journals.staffs.ac.uk/index.php/ipihe/article/viewFile/188/284

Maxwell, J. A. (2012). *Qualitative research design: An interactive approach* (3rd ed.). Sage Publications.

McCay-Peet, L., & Quan-Haase, A. (2016). What is social media and what questions can social media research help us answer? In L. Sloan, & A. Quan-Haase (Eds.), *The SAGE handbook of social media research methods* (pp. 13-26). Sage Publications Ltd. https://doi.org/10.4135/9781473983847.n2

Miles, B. M., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publications.

Miles, M. B., Huberman, A. M., & Saldana, J. (2020). *Qualitative data analysis: A methods sourcebook* (4th ed.). Sage Publications.

Mpungose, C. B. (2020). Are social media sites a platform for formal or informal learning? Students' experiences in institutions of higher education. *International Journal of Higher Education*, *9*(5), 300-311. https://doi.org/10.5430/ijhe.v9n5p300

Ohei, K. N. (2019). Integration of social media technologies and applications to serve as blended approaches to traditional teaching and learning method: A case study of South African universities. *International Journal of Social Media and Interactive Learning Environments*, *6*(2), 150-167. https://doi.org/10.1504/IJSMILE.2019.102174

Potter, J. (2011). New literacies, new practices and learner research: Across the semi-permeable membrane between home and school. *Lifelong Learning in Europe*, *16*(3), 174–181. https://discovery.ucl.ac.uk/id/eprint/1526324/

Reich, Y., Konda, S. L., Monarch, I. A., Levy, S. N., & Subrahmanian, E. (1996). Varieties and issues of participation and design. *Design Studies*, *17*(2), 165-180. https://doi.org/10.1016/0142-694X(95)00000-H

Rice, J. A. (2009). Devising collective knowledges for the technical writing classroom: A course-based approach to using Web 2.0 writing technologies in collaborative work tutorial. *IEEE Transactions on Professional Communication*, *52*(3), 303-315. https://doi.org/10.1109/TPC.2009.2025310

Ritzer, G, & Jurgenson, N. (2010). Production, consumption, prosumption: The nature of capitalism in the age of the digital 'prosumer'. *Journal of Consumer Culture*, *10*(1), 13-34. https://doi.org/10.1177/1469540509354673

Sanders, E. B.-N., Brandt, E., & Binder, T. (2010, November). A framework for organizing the tools and techniques of participatory design. In *Proceedings of the 11th Biennial Participatory Design Conference (PDC '10)* (pp. 195-198). Sydney, Australia: ACM. https://doi.org/10.1145/1900441.1900476

Santoveña Casal, S. (2019). The impact of social media participation on academic performance in undergraduate and postgraduate students. *International Review of Research in Open and Distributed Learning*, *20*(1), 125-143. https://doi.org/10.19173/irrodl.v20i1.3751

Saura, J. R., Reyes-Menendez, A., & Bennett, D. R. (2019). How to extract meaningful insights from UGC: A knowledge-based method applied to education. *Applied Sciences*, *9*(21), 4603. https://doi.org/10.3390/app9214603

Sensarkar, N. (2009). How prepared is the Indian entertainment industry to tackle the challenges posed by Web 2.0? *Journal of Intellectual Property Law & Practice*, *4*(8), 592-599. https://doi.org/10.1093/jiplp/jpp095

Simonsen, J., & Robertson, T. (Eds.). (2013). *Routledge international handbook of participatory design*. Routledge. https://doi.org/10.4324/9780203108543

Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020). Responses to COVID-19 in higher education: Social media usage for sustaining formal academic communication in developing countries. *Sustainability*, *12*(16), 6520. https://doi.org/10.3390/su12166520

Stathopoulou, A., Siamagka, N. T., & Christodoulides, G. (2019). A multi-stakeholder view of social media as a supporting tool in higher education: An educator–student perspective. *European Management Journal*, *37*(4), 421-431. https://doi.org/10.1016/j.emj.2019.01.008

Staub, T., & Hodel, T. (2016). Wikipedia vs. academia: An investigation into the role of the internet in education, with a special focus on Wikipedia. *Universal Journal of Educational Research*, *4*(2), 349-354. https://doi.org/10.13189/ujer.2016.040205

Talaue, G. M., AlSaad, A., AlRushaidan, N., AlHugail, A., & AlFahhad, S. (2018). The impact of social media on academic performance of selected college students. *International Journal of Advanced Information Technology (IJAIT)*, *8*(4/5), 27-35. https://doi.org/10.5121/ijait.2018.8503

Tess, P. A. (2013). The role of social media in higher education classes (real and virtual) – A literature review. *Computers in Human Behaviour*, *29*(5), A60-A68. https://doi.org/10.1016/j.chb.2012.12.032

Tinmaz, H. (2012). Social networking websites as an innovative framework for connectivism. *Contemporary Educational Technology*, *3*(3), 234-245. https://doi.org/10.30935/cedtech/6080

Tu, C. H., Sujo-Montes, L., Yen, C. J., Chan, J. Y., & Blocher, M. (2012). The integration of personal learning environments & open network learning environments. *TechTrends*, *56*(3), 13-19. https://doi.org/10.1007/s11528-012-0571-7

Yan, Y., Davison, R. M., & Mo, C. (2013). Employee creativity formation: The roles of knowledge seeking, knowledge contributing and flow experience in Web 2.0 virtual communities. *Computers in Human Behaviour*, *29*(5), 1923-1932. https://doi.org/10.1016/j.chb.2013.03.007

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Sage Publications Ltd.

Zemelman, S., Daniels, H., & Hyde, A. (2012) *Best practice: New standards for teaching and learning in America's schools* (4th ed.). Heinemann.

Zheng, B., Niiya, M., & Warschauer, M. (2015). Wikis and collaborative learning in higher education. *Technology, Pedagogy and Education*, *24*(3), 357-374. https://doi.org/10.1080/1475939X.2014.948041

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