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DEVELOPMENT ARTICLE

Exploring the communication preferences of MOOC learners and the value of preference-based groups: Is grouping enough?

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Abstract Approximately 10 % of learners complete Massive Open Online Courses (MOOCs); the absence of peer and professor support contributes to retention issues. MOOC leaders often form groups to supplement in-course forums and Q&A sessions, and students participating in groups find them valuable. Instructors want to assist in the formation of groups, creating multi-national collaborations, an asset possible in MOOCs that is generally sacrificed when students form their own groups. Little is known about how people from various cultures prefer to communicate with each other, or about the value of groups formed by MOOC leaders. To understand MOOC leaners' grouping preferences, we administered a pre-course online survey to volunteers registered in the "Creativity, Innovation, and Change" MOOC offered by Penn State University via Coursera and assigned volunteers to groups based on their preferences. We also examined whether assigning learners to groups based on their preferences enhanced their performance or completion of the course. This paper reports MOOC learners' preferences for different modes of online communication with group members (asynchronous text posts, synchronous text chats, or synchronous video and audio). Statistically significant relationships were found between learners' preferred communication modes and their level of English proficiency, gender, level of education, and age. Although placing learners in groups based on their preferences and introducing them to each other did not improve course performance or completion, our findings on preferred communication modes, combined with

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more formal instruction of how to function as group members may prove to enhance learning and engagement in MOOCs.

Keywords Communication preferences · Peer support · MOOC · Group learning · Social learning

Massive Open Online Courses (MOOCs) offer free and open access to high quality college-level course content, delivered by prestigious universities. They recruit large global audiences, filling a void between formal and informal learning options. They also bring outstanding potential for learners and great opportunities for conducting research on learning in general, with special insights on distance and online learning.

Institutions are making significant investments in MOOCs, but the high attrition rates (Perna et al. 2014) leave them vulnerable to criticism related to the quality and importance of their investments. These high attrition rates could be, in part, tied to the students' feelings of social isolation and other factors affecting retention and dropout rates in traditional distance education settings (Kamel Boulos and Wheeler 2007).

Even in much smaller courses, students can feel socially isolated when they are geographically separated during their studies (Kamel Boulos and Wheeler 2007), but additional variables can affect retention and dropout rates when learning at a distance. Berge and Huang (2004) summarize these variables, listing: personal variables (age, gender, parental expectation, academic skills, prior schooling achievements, etc.); institutional variables (mission, budgeting, institutional participation, etc.); and circumstantial variables (bureaucratic interactions, social interactions, life circumstances, work circumstances, etc.).

Although the circumstantial variables listed above (job change, lack of employer's support, or health reasons) explain a portion of MOOC student attrition rates (Gütl et al. 2014), dropout and disengagement rates in MOOCs have been reported as higher and "far steeper than expected" (Wang 2013, as cited in Yang et al. 2013, p. 3), and a segment of this attrition appears to be a gradual process, suggesting that there are MOOC students who remain in the course but who "are struggling to stay involved" (Yang et al. 2013, p. 2). Yang et al. (2013) have explored factors that affect dropout rates in MOOCs and report that social engagement promotes commitment and lower attrition.

Literature review

Social engagement and learning

For decades, educational researchers have documented the advantages of social engagement in the form of peer-to-peer interactions in learning. Wellman et al. (1996) ascertained that people reported feeling social support, companionship, and a sense of belonging while engaged in a "Computer Supported Social Network". Based on experience with social forms of learning, Siemens (2005) developed the concept of "connectivism," through which he described learning as developing during a social process of network formation and knowledge creation. Based on Vygotsky's (1978) Zone of Proximal Development (i.e., the distance between the actual development level and the potential level a learner can

reach under the guidance of an adult or more capable peers), peer support has been viewed as a crucial part of individual cognitive development. Also, "scaffolding" (Wood et al. 1976) was identified as effective assistance provided by more competent learners to less skilled learners to achieve a higher performance level. Social and peer support play an important role in achieving success in learning, and the development of personal relationships has been identified as a key element in fostering motivation and collaboration within a group.

MOOCs and learning

As Alario-Hoyos et al. (2013) discuss, MOOCs offer social tools to create a community of participants to provide support and advice to each other. The authors also observe that a few of the thousands of registered MOOC users who were competent and knowledgeable were playing the role of volunteer mentors, and those volunteer mentors were filling the gap in student-to-instructor interactions. Through engagement and communication, members feel socially connected with one another.

MOOC providers have been exploring new ways of attracting and retaining students by embedding Web 2.0 technologies into their platforms to engage the massive number of participants (Stewart 2010; McLoughlin and Lee 2010; Alario-Hoyos et al. 2013; Friedman and Friedman 2013) because Web 2.0 technologies are making it less costly and much easier for students to collaborate and to experience student-to-student interaction. As a result, MOOCs have been viewed as a digital learning innovation that has the potential to reflect the personal, networked, and openly collaborative practices and principles of Web 2.0 (Stewart 2010; McLoughlin and Lee 2007, 2008, 2010; Siemens 2005).

The case has been made for peer-to-peer support in learning. Even in the very first MOOCs, students in different parts of the world spontaneously formed groups and supported each other. Now, MOOC providers have begun to encourage the formation of study groups, but when truly global populations are to be placed into groups, many questions emerge. What are the dynamics of online presence, and social and peer collaboration in MOOC environments? How can students across different time zones work in groups? Can formal group formation enhance community and reduce dropout rates in MOOCs? What do MOOC learners think about the value of groups? What are their preferred ways to communicate with each other when working in groups to complete MOOCs? When students are assigned to groups, do participation and achievement levels improve? Are there differential benefits between learners' places in asynchronous and synchronous groups?

Purpose of the study

The primary purpose of this study was to understand the communication-related preferences of MOOC learners, so that learner preferences might be used to inform MOOC providers during the formation of groups, without the effort and delay caused by pre-course surveys. The secondary purpose of the study was to determine whether simply assigning learners to groups, based on their grouping preferences, was enough to influence the rate of course completion. A tertiary purpose was to add to the knowledge base on persistence and course completion in MOOCs.

In a pre-course survey, we asked students who volunteered to be placed into groups to answer several grouping preference questions. One of the survey items asked the students

to rank the importance of nine factors that might be used to form groups, such as: language, age, education, gender, intention to complete the course, country of origin, profession, and time available to meet as a group. The grouping factors study, reported in two 2015 conference presentations (Hristova and Bayeck 2015), used a 1–9 ranking scale, with one being most important and nine being least important factor. The language to be used to communicate with group members, learners' intentions to complete the course, and best times to meet as a group were ranked highest and were used to guide our group formations.

This paper presents findings on the mode of communication (asynchronous posts, synchronous chats, or synchronous video and audio) CIC MOOC learners preferred to use to communicate with other group members and how demographic factors influence these preferences. We also report initial findings on the perceived value of assigning learners to groups according to their preferences.

Research questions and methods

The specific research questions addressed by this study are:

When communicating with learners from other parts of the world in MOOCs:

1. Which mode of communication do learners prefer: asynchronous text posts, synchronous text chats, or synchronous video- and audio-based communication?
2. Is there a significant relationship between MOOC learners' communication mode preferences and:
    a. Level of English proficiency?
    b. Gender?
    c. Level of education?
    d. Age?
3. Were there differences in course participation and achievement based on assignment to synchronous or asynchronous groups?

Grouping procedure

Participants in the "Creativity, Innovation, and Change" MOOC (CIC MOOC) offered by Penn State University through the Coursera platform (Jablokow et al. 2014) were invited to volunteer for a research study in which they would be placed into groups to enhance their MOOC experience. To address our research questions, we conducted pre-course and post-course surveys. Since all course content was available in Chinese, our survey questions were available in Chinese as well. Surveys were delivered online via Qualtrics and survey results were analyzed using SPSS.

To determine the communication medium preferred by each learner, we used the following pre-course survey item and answer choices:

What is your preferred way to communicate with your group?

(A) Text-based posts—not in real time (as in Coursera forums, Blogs, QQ Zones, emails, Twitter, etc.)
(B) Text-based chats—synchronous communications among group members who are online at the same time (as in instant messages, Skype, Google chats, QQ, WeChat, etc.)

(C) Video and audio-based real time conversations (as in Skype, Zoom, Google Hangouts, etc.)
(D) Other—please specify.

Seven-hundred-and-seventy (770) pre-course surveys were submitted.

In our post-course survey, to determine what learners actually used rather than what they had been assigned to use, to understand the effects of these tools on group work, and to identify any other tools we may have omitted in our pre-course survey, we included the question: "Which social media tools did your group use to communicate with each other?" We also asked questions such as: "When did you start meeting with your teammates? Did you form your own (or different) group in or outside Coursera? Did your group assign a leadership role to anyone? How often did your group meet? and Did your group work effectively?" Results from the 97 participants who completed the post-course grouping survey are used in this study to report preferred tools, and to provide insights into group dynamics and the perceived and measurable values of the different types of groups.

After analyzing learners' preferences, as indicated in the pre-course survey, we assigned users to 42 groups based on their preferred modes of communication and, if a synchronous mode had been selected, based on their preferred times to work together. (See Table 1 below.) We then informed participants, through emails, of the others who were in their groups and provided instructions suggesting the tools through which they might "meet." We encouraged the asynchronous text-based groups to interact with one another via tools such as email, Coursera Forums, Facebook, blogs, etc., and we encouraged synchronous groups to use text-based chats like Twitter and Google chats and/or video- and audio-based tools such as Skype, Zoom, and Google Hangouts.

Because tools like Facebook, Google+ , YouTube, and others have been blocked in China, and many Chinese participants would be more familiar with other tools available in different parts of the world, QQ, WeChat, and WhatsApp were added as communication options. We also directed the one large "ad-hoc" group to use three online video- and audio-based meeting "Zoom rooms" specifically created for the CIC grouping study through ZOOM.us. Zoom was selected because these meeting spaces are easily accessible from around the world, and because a standard meeting location could be established for use throughout the study.

Nature of the course, tasks and evaluation of group work

The Creativity, Innovation and Change (CIC) MOOC 2.0 was offered by professors at Pennsylvania State University. No prerequisites are required before taking the course. This course aims to stimulate creative changes in individuals, organizations and nations, and each week's lesson consists of short videos to highlight new concepts and examples. Six submissions are required, one each week, to earn a Statement of Accomplishment, and an additional 12 peer reviews during the course are required to earn a Statement of Accomplishment with Distinction. The submissions include creative exercises and reflective surveys. Students are capable of completing the exercises on their own, and no collaborative or cooperative work is required. The six creative exercises (one per week) were as follows:

- Week 1: Shoe Tower—This exercise focused on prototyping and appreciating and value of fast failure. Learners built the tallest free-standing tower possible using only shoes. Students calculated the "T-value" of each tower, defined as the quotient of the tower height and the number of shoes. Learners also assessed their own towers in terms

Table 1 Groups formed based on pre-course survey and groups represented in post-course survey

Group language	Survey	Synchronous groups						Asynchronous groups					
		Intention to complete						Intention to complete					
		All		Most		Mixed		All		Most		Mixed	
		Groups	*n*	Groups	*n*	Groups	*n*	Groups	*n*	Groups	*n*	Groups	*n*
English	Pre	9	83	5	36	–	–	8	105	2	24	3	36
	Post	8	15	2	3	–	–	7	20	2	2	3	3
Chinese	Pre	2	12	2	14	–	–	1	8	–	–	1	8
	Post	1	1	1	1	–	–	1	3	–	–	1	1
Spanish	Pre	–	–	–	–	–	–	1	7	–	–	–	–
	Post	–	–	–	–	–	–	0	0	–	–	–	–
Mixed Languages	Pre	–	–	–	–	–	–	–	–	–	–	2	30
	Post	–	–	–	–	–	–	–	–	–	–	2	3
Total	Pre	11	95	7	50	–	–	10	120	2	24	6	74
	Post	9	16	3	4	–	–	8	23	2	2	6	7

Table 1 continued

Group language	Survey	Control groups							Total	
		Intention to complete						One Ad Hoc zoom group (Mixed)		
		All sync		Most sync		Mixed async				
		Groups	*n*	Groups	*n*	Groups	*n*		Groups	*n*
English	Pre	1	28	1	22	1	108	231	31	673
	Post	1	1	1	1	1	17	19	26	81
Chinese	Pre	1	8	1	4	–	–	–	8	54
	Post	0	0	0	0	–	–	–	4	6
Spanish	Pre	–	–	–	–	–	–	–	1	7
	Post	–	–	–	–	–	–	–	0	0
Mixed Languages	Pre	–	–	–	–	–	–	–	2	30
	Post	–	–	–	–	–	–	–	2	3
Total	Pre	2	36	2	26	1	108	231	42	764
	Post	1	1	1	1	1	17	19	32	90

of how creative and how beautiful they felt them to be and reflected on the role of failure in completing the task to their satisfaction.

- Week 2: Creative Style Estimation—This exercise focused on personal insight about preferred approach to creativity (known as "creative style"). Learners answered a set of questions related to the structure of their thinking. These questions were scored in Qualtrics, and a creative style score was returned to each student. Students reflected on their results and the advantages and disadvantages of being the style they are.
- Week 3: Life Ring—This exercise focused on setting goals and "centering" one's thinking in order to accomplish those goals. Learners constructed a Life Ring that incorporated key driving forces, major categories, desired outcomes, and important goals in their lives. Students reflected on their results and the action steps they took to move toward their stated goals.
- Week 4: Bold Acts of Defiance—This exercise focused on challenging the status quo and learning how to tolerate greater levels of risk. Learners were instructed to defy a cultural norm without breaking the law or causing danger to themselves or others. Students reflected on the process they experienced and how what they learned would help them in future problem solving situations.
- Week 5: Action Map—This exercise focused on identifying real needs by observing others in challenging situations. Learners identified multiple needs, pains, or problems in their communities and shared those ideas with others in order to identify which problems they might pursue further. Students reflected on how they might prototype and test solutions to the key problem they identified.
- Week 6: Branding—This exercise focused on establishing a personal "brand" to represent one's identity and/or the core of one's product or service offering. Learners constructed tangible, authentic, and relevant items that represented some aspect of what they as individuals and/or their products and services do or stand for. Students reflected on the meaning of their brand and how the lessons from the course affected their branding process.

In each of the exercises described above, many learners shared the results of their work (e.g., pictures of their shoe towers, images of their Life Rings, reflections on their experiences or insights) in online platforms where the works were accessible to the public, including the Coursera Forum; others communicated through emails, and some social media tools that only allowed group members to participate and view group discussions (e.g., QQ used by many Chinese participants).

Results

Study participants

As shown in Table 2 below, 60 % of the 655 people who completed the pre-course survey and had valid Coursera participation and performance records were women, and 38 % were men. One and a half percent (1.5 %) declined to respond to the item asking about gender. In the CIC MOOC as a whole, 52 % were male and 48 % were female, so a larger percentage of females than males chose to participate as members of groups rather than completing the course independently.

As is also shown in Table 2, students participating in the grouping study represented 82 countries, which is approximately 44 % of the 187 countries represented by the 3757

Table 2 Course and grouping study participation by gender and country

Comparison of course participants and grouping study participants	In CIC MOOC		In grouping study	
	Number	Percent	Number	Percent
Gender	$N = 3803$[a]		$N = 655$[c]	
Female	1825	48	381	60
Male	1978	52	245	38
Countries represented	187		92	
Country of participation	$N = 39{,}069$[b]		$N = 863$[c]	
China	9377	24	165	25
India	2735	7	54	8
United States	7423	19	130	20
Other	19,534	47	385	45

[a] The number of people registered for the course and who also completed the optional survey gathering gender information

[b] The number of students who visited the course at least once

[c] The number of people who completed the pre course grouping survey and had valid participation and performance records in Coursera

students who registered for the course and completed the optional Coursera demographic survey. This CIC MOOC attracted a significant number of Chinese learners, representing 24 % of those visiting the course at least once; this may be because the course contents had been translated into Chinese, which reduced the language barrier. Chinese students comprised a comparable percentage (25 %) of the grouping study participants, indicating that Chinese students were not significantly more likely to value group participation than learners from other nations.

Figure 1 and Table 3 below show data on the learners' intentions to complete the course. It is obvious that our grouping study attracted learners who were very committed to the course, intending to complete all or most assignments (65 and 30 %, respectively).

Figure 2 below shows the employment/student status of the study participants. The majority of the students (60 %) in this study are either working or studying full time, and only 5 % are full-time job seekers.

Based on the data presented in Tables 2 and 3 and Fig. 1 above, it appears that participation in the grouping study seems to have been more attractive to females than males and more attractive to students who intended to complete all or most of the course assignments.

Preferred language for group participation

The vast majority of participants (80 %) preferred to use English as the primary language to communicate within their groups, followed by Chinese (13 %), and a few other

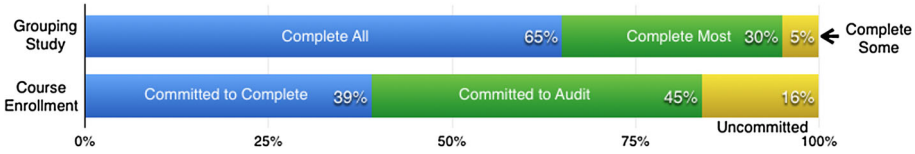

Fig. 1 Percentage of learners in the course and the grouping study by intention to complete

Table 3 Summary of learner intentions in the course and the grouping study

Comparison of course participants and grouping study participants	In CIC MOOC		In grouping study		
	Number	Percent		Number	Percent
Intention to complete	$N = 39{,}069$[a]			$N = 655$[b]	
Committed to complete	15,231	39	Complete all	426	65
Committed to audit	17,741	45	Complete most	196	30
Uncommitted	6097	16	Complete some	30	5
Total:	39,069	100	Complete none	3	1

[a] The number of students who visited the course at least once

[b] The number of people who provided answers to these items on the pre-course grouping survey and had valid participation and performance data on Coursera

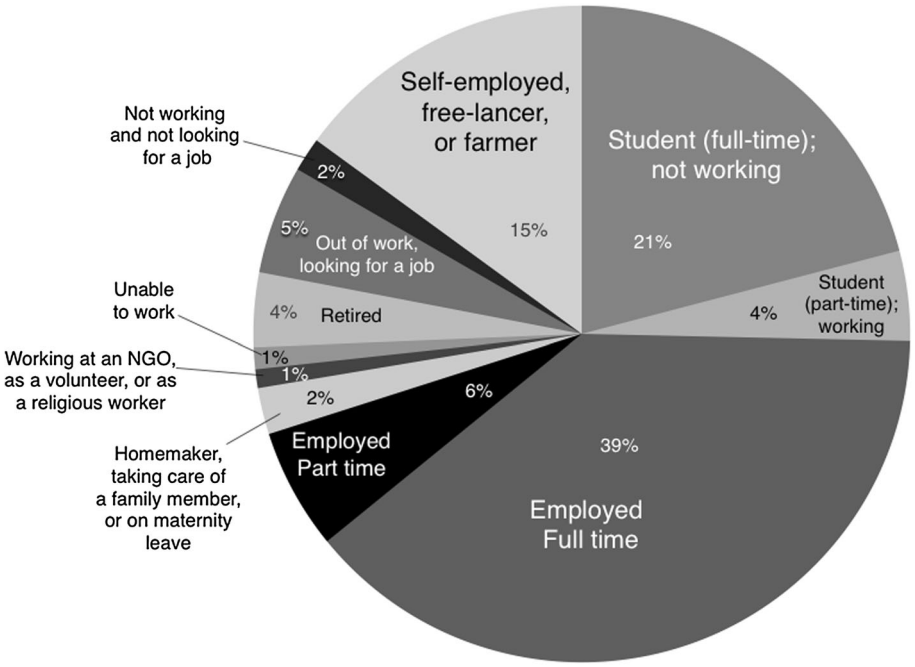

Fig. 2 Employment/student status of study population

requested languages, including Spanish, Arabic, French, and Russian. It should be noted that although 25 % of the participants in the grouping study were Chinese, only 13 % of the study participants reported wanting to participate in groups that spoke Chinese, indicating that *almost half of the Chinese learners wanted to interact with group members in English*.

Preferred mode of communication

In our pre-course survey, we asked learners to choose their preferred mode of communication, which included synchronous collaboration (group members meeting and working online at the same time) and asynchronous collaboration (group members meeting and working at various times according to their own availabilities). Fifty-five percent (53 %) of the participants chose to use synchronous communication tools, including chats (38 %) or video and audio (15 %) to work with their group, whereas forty-five percent (45 %) of the participants chose to communicate asynchronously through text-based posts, and 3 % indicated that they would prefer "other" methods.

As illustrated in Fig. 3 below, of the 655 respondents, 45 % chose to use text-based posts (asynchronous), and 38 % chose to use text-based chats (synchronous), while only 15 % preferred synchronous video- and audio-based conversations as their communication modes.

English language proficiency and preferred mode of communication

An analysis of the relationship between English language proficiency and communication mode preferences (see Tables 4 and 5) revealed a statistically significant relationship. As Table 4 and Fig. 4 illustrate, preferences shift away from synchronous chats and toward asynchronous posts as the level of English proficiency increases.

Gender and preferred mode of communication

As shown in Tables 6 and 7 below, and as illustrated in Fig. 5, a statistically significant relationship between gender and preferred mode of communication was also demonstrated. Males were more likely to prefer synchronous forms of communication than females.

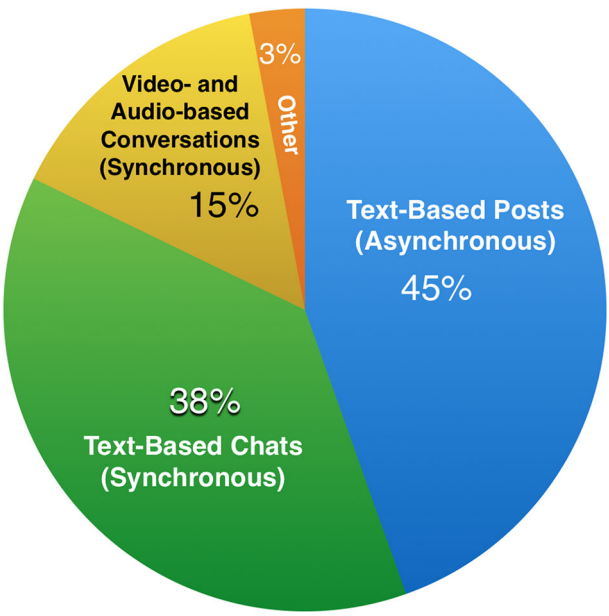

Fig. 3 Distribution of MOOC learners' preferred communication modes

Table 4 English proficiency by preferred mode of communication

	Text-based post[a]		Text-based chat[a]		Video and audio based conversation[a]		Total	
	N	%	*N*	%	*N*	%	*N*	%
Poor	14	35	23	57.5	3	7.5	40	100.0
Basic	60	39.5	78	51.3	14	9.2	152	100.0
Fluent	105	39.3	108	40.4	54	20.2	267	100.0
Native speaker	114	63.7	38	21.2	27	15.1	179	100.0
Total	293	45.9	247	38.7	98	15.4	638	100.0

[a] Text-based posts are asynchronous, text-based chats and video- and audio-based conversations are synchronous

Table 5 English Proficiency and preferred mode of communication—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	50.944	6	0.000
Likelihood ratio	52.269	6	0.000
Linear-by-linear association	4.894	1	0.027
N	638		

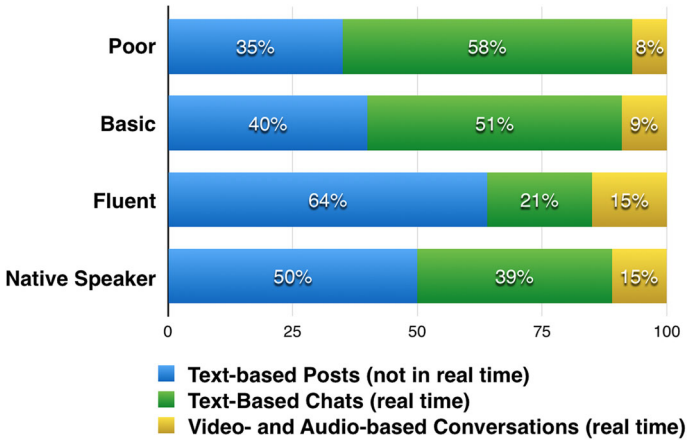

Fig. 4 Patterns of preferred communication mode by levels of english proficiency

Education level and preferred mode of communication

Thirty-six percent (36 %) of participants had already attained a bachelor's degree, and another 31 % had already attained a degree beyond the bachelor's degree (24 % Masters Degree and 7 % Doctoral or Professional School degree).

As shown in Tables 8 and 9, and as illustrated in Fig. 6, there is a statistically significant relationship between the learners' highest level of education and their preferred modes of

Table 6 Gender and preferred mode of communication

	Text-based post[a]		Text-based chat[a]		Video and audio based conversation[a]		Total	
	N	%	*N*	%	*N*	%	*N*	%
Female	192	50.4	140	36.7	49	12.9	381	100.0
Male	97	39.6	100	40.8	48	19.6	245	100.0
Total	289	46.2	240	38.3	97	15.5	626	100.0

[a] Text-based posts are asynchronous, text-based chats and video- and audio-based conversations are synchronous

Table 7 Gender and preferred mode of communication—χ^2

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	8.773	2	0.012
Likelihood ratio	8.742	2	0.013
Linear-by-linear association	8.758	1	0.003
N	626		

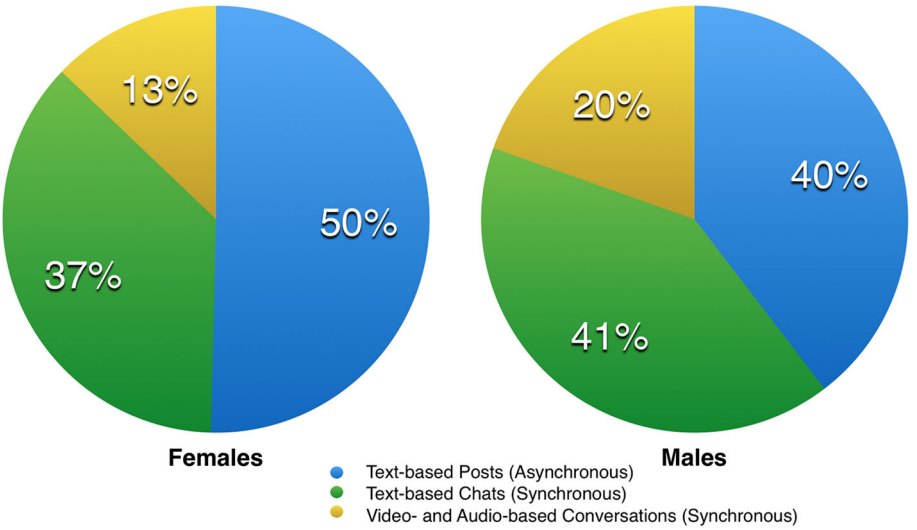

Fig. 5 Gender and preferred mode of communication

communication. As education level increases, the learners' preference for synchronous communications (real-time text chats, as well as live video and audio) diminishes. *Participants without degrees and with lower-level degrees are more likely to prefer text-based real-time chats, while people with higher levels of education (bachelor's degree and above), are more likely to prefer asynchronous text-based posts.*

Table 8 Levels of highest education and preferred communication mode

	Text-based post[a]		Text-based chat[a]		Video and audio based conversation[a]		Total	
	N	%	*N*	%	*N*	%	*N*	%
High school drop out	5	35.7	6	42.9	3	21.4	14	100.0
High school diploma and equivalent	17	27.9	33	54.1	11	18	61	100.0
Some college	33	40.7	40	49.4	8	9.9	81	100.0
Associate's degree	13	30.2	19	44.2	11	25.6	43	100.0
B.A. Degree	112	48.7	85	37.0	33	14.3	230	100.0
Master's Degree	83	53.5	47	30.3	25	16.1	155	100.0
Ph.D. or Professional Degree	29	63	10	21.7	7	15.2	46	100.0

[a] Text-based posts are asynchronous, text-based chats and video- and audio-based conversations are synchronous

Table 9 Highest level of education and preferred communication mode—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	30.098	12	0.002
Likelihood ratio	31.493	12	0.002
Linear-by-linear association	9.632	1	0.002
N	630		

Age and preferred mode of communication

As shown in Tables 10 and 11, and as illustrated in Fig. 7, a statistically significant relationship between age category and preferred mode of communication was also evident.

In Fig. 7, we see that the two youngest age categories, encompassing learners between 10 and 29, demonstrated a preference for real-time, text-based chats, but as age increases, the preference shifts to asynchronous text-based posts, such as those employed by the Coursera forums and in Facebook groups.

Employment, hours worked, and preferred mode of communication

The findings with regard to age could be indicative of other factors that are positively correlated with age, such as the number of hours spent working, which might, for example, influence the time available for synchronous conversation and perhaps create a need for asynchronous posts. To further investigate this, we looked at the population in terms of employment and/or student status (see Fig. 2 above) and the number of hours worked (see Table 12). As Table 13 shows, there was no statistically significant relationship between the number of hours worked and the preferred communication mode.

Course completion for synchronous vs asynchronous groups

As represented in Tables 14 and 15 below, there was no statistically significant difference between the course completion levels exhibited by people who requested and were assigned to synchronous and asynchronous groups and those assigned to control groups.

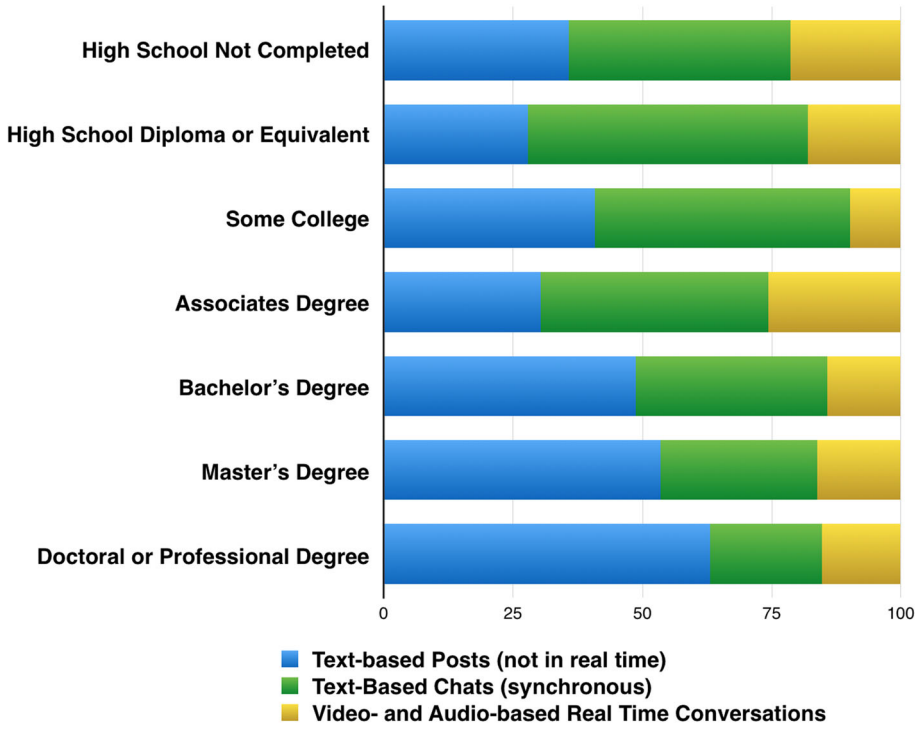

Fig. 6 Education level and preferred communication mode

Table 10 Age and preferred communication mode

	Text-based post[a]		Text-based chat[a]		Video and audio based conversation[a]		Total	
	N	%	*N*	%	*N*	%	*N*	%
10–19	18	25.7	45	64.3	7	10	70	100.0
20–29	77	34.1	112	49.6	37	16.4	226	100.0
30–39	59	45.0	45	34.4	27	20.6	131	100.0
40–49	52	56.5	26	28.3	14	15.2	92	100.0
50–59	51	71.8	12	16.9	8	11.3	71	100.0
60 and above	32	78.0	4	9.8	5	12.2	41	100.0
Total	289	45.8	244	38.7	98	15.5	631	100.0

[a] Text-based posts are asynchronous, text-based chats and video- and audio-based conversations are synchronous

Seventy percent of learners in asynchronous did not complete the course, while 74 % of synchronous group members and 73 % of control group members did not complete the course.

Table 11 Age and preferred communication mode—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	79.464	10	0.000
Likelihood ratio	81.947	10	0.000
Linear-by-linear association	32.49	1	0.000
N	631		

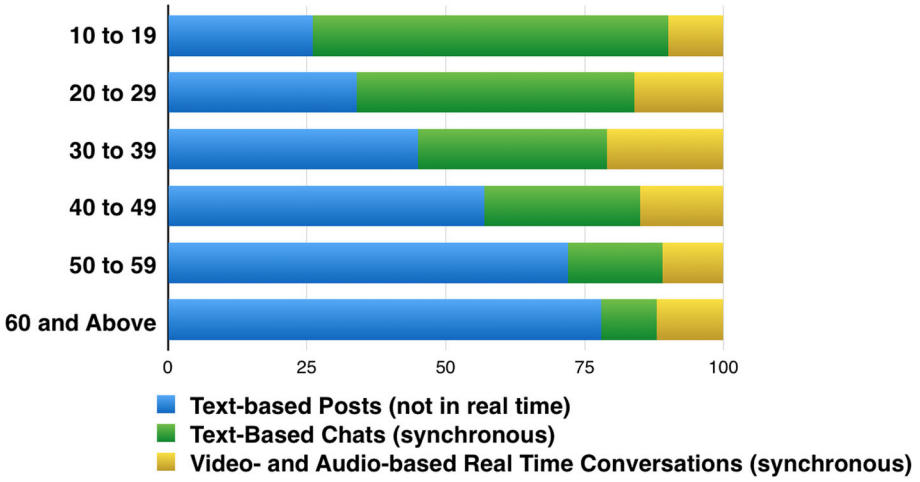

Fig. 7 Age and preferred communication mode

Table 12 Hours per week and preferred communication mode

	Text-based post[a]		Text-based chat[a]		Video and audio based conversation[a]		Total	
	N	%	*N*	%	*N*	%		%
0–20	38	44.7	32	37.6	15	17.6	85	100.0
20–40	89	56	47	29.6	23	14.5	159	100.0
40+	94	55.6	49	29	26	15.4	169	100.0
Total	221	53.5	128	31	64	15.5	413	100.0

[a] Text-based posts are asynchronous, text-based chats and video- and audio-based conversations are synchronous

Table 13 Hours per week worked and preferred communication mode—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	3.454	4	0.485
Likelihood ratio	3.443	4	0.487
Linear-by-linear association	1.318	1	0.251
N	413		

Table 14 Achievement level distribution among synchronous and asynchronous groups

Groups Assigned		Achievement level			Total
		Did not complete	Completed	Completed with distinction	
Asynchronous groups	Count	146	19	44	209
	% within groups assigned	69.9 %	9.1 %	21.1 %	100 %
Synchronous groups	Count	87	9	21	117
	% within groups assigned	74.4 %	7.7 %	17.9 %	100 %
Control groups	Count	240	20	69	329
	% within groups assigned	72.9 %	6.1 %	21.0 %	100 %
Total	Count	473	48	134	655
	within groups assigned	72.2 %	7.3 %	20.5 %	100 %

Table 15 Achievement level distribution among synchronous and asynchronous groups—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	2.307	4	0.680
Likelihood ratio	2.302	4	0.680
Linear-by-linear association	0.14	1	0.709
N	655		

Course completion and english proficiency

As Tables 16 and 17 below reveal, there was no statistically significant difference between the course completion levels exhibited by learners with different levels of English proficiency.

Course completion and education level

As depicted in Tables 18 and 19 below, there was no statistically significant difference between the course completion levels exhibited by learners based on the highest level of education they had completed.

Course completion and age

As Tables 20 and 21 below show, the differences in course completion were not statistically significant when learners' ages were categorized in 10-year spans. However, as displayed in Tables 22 and 23 below, when age is categorized as below or above age 40, an age at which most people are out of college, have stable employment, and may have raised children that require less time of their parents, there is a significant difference in completion rates, with learners over 40 displaying greater rates of completion and completion with distinction than learners under age 40.

Table 16 Achievement levels by levels of english proficiency

	Did not complete		Completed		Completed with distinction		Total	
	N	%	*N*	%	*N*	%	*N*	%
Poor	29	72.5	6	15.0	5	12.5	40	100.0
Basic	118	76.1	9	5.8	28	18.1	155	100.0
Fluent	199	72.9	18	6.6	56	20.5	273	100.0
Native speaker	127	67.9	15	8.0	45	24.1	187	100.0
Total	473	72.2	48	7.3	134	20.5	655	100.0

Table 17 Achievement levels by levels of english proficiency—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	7.713	6	0.260
Likelihood ratio	7.16	6	0.306
Linear-by-linear association	2.951	1	0.086
N	655		

Table 18 Achievement levels by highest levels of education completed

	Did not complete		Completed		Completed with distinction		Total	
	N	%	*N*	%	*N*	%	*N*	%
High school drop out	9	64.3	2	14.3	3	21.4	14	100.0
High school diploma or equivalent	49	77.8	4	6.3	10	15.9	63	100.0
Some college	68	79.1	6	7.0	12	14.0	86	100.0
Associates Degree	37	84.1	1	2.3	6	13.6	44	100.0
B.A. Degree	157	67.1	16	6.8	61	26.1	234	100.0
Master's Degree	112	70.4	16	10.1	31	19.5	159	100.0
Ph.D. or Professional Degree	34	72.3	2	4.3	11	23.4	47	100.0
Total	466	72.0	47	7.3	134	20.7	647	100.0

Course completion and gender

As shown in Tables 24 and 25 below, the differences in course completion between males and females were not statistically significant.

Communication tools employed by student groups

In addition to data on preferred modes of communication, we also gathered data from the 115 completed post-course surveys on the tools learners actually chose to use during their group work. The results are shown in Table 26.

Table 19 Achievement levels by highest levels of education completed—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	14.83	12	0.251
Likelihood ratio	15.258	12	0.228
Linear-by-linear association	2.604	1	0.107
N	647		

Table 20 Achievement by age category: 10 year spans

	Did not complete		Completed		Completed with distinction		Total	
	N	%	*N*	%	*N*	%	*N*	%
10–19	55	78.6	6	8.6	9	12.9	70	100.0
20–29	175	75.4	15	6.5	42	18.1	232	100.0
30–39	101	75.9	6	4.5	26	19.5	133	100.0
40–49	66	69.5	7	7.4	22	23.2	95	100.0
50–59	46	60.5	9	11.8	21	27.6	76	100.0
60 and above	26	61.9	4	9.5	12	28.6	42	100.0
Total	469	72.4	47	7.3	132	20.4	648	100.0

Table 21 Achievement levels by age category: 10 year spans—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	13.662	10	0.189
Likelihood ratio	13.545	10	0.195
Linear-by-linear association	9.448	1	0.002
N	648		

Table 22 Achievement levels by age category—under 40 or 40 and older

	Did not complete		Completed		Completed with distinction		Total	
	N	%	*N*	%	*N*	%	*N*	%
Under 40	331	76.1	27	6.2	77	17.7	435	100.0
40 or above	138	64.8	20	9.4	55	25.8	213	100.0
Total	469	72.4	47	7.3	132	20.4	648	100.0

From the data in Table 26, QQ ranked as the most frequently used tool, probably due to the large number of Chinese enrollments. Facebook and the Coursera forums were the second and third most used tools, respectively. Some students also met face-to-face, and some tools not included in our survey, such as "WhatsApp" and wikis, were used to support group work.

Table 23 Achievement levels by age category: under 40 or 40 and older—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	9.15	2	0.010
Likelihood ratio	8.943	2	0.011
Linear-by-linear association	8.198	1	0.004
N	648		

Table 24 Achievement levels by gender

	Did not complete		Completed		Completed with distinction		Total	
	N	%	*N*	%	*N*	%	*N*	%
Female	280	71.1	32	8.1	82	20.8	394	100
Male	183	73.5	16	6.4	50	20.1	249	100
Total	463	72	48	7.5	132	20.5	643	100

Table 25 Achievement levels by gender—χ^2 analysis

	Value	DF	Asymp. sig (2-sided)
Pearson χ^2	0.753	2	0.686
Likelihood ratio	0.764	2	0.682
Linear-by-linear association	0.23	1	0.631
N	643		

Table 26 Communication tools used in group work

	N	%
QQ	19	20.4
Facebook	15	16.1
Coursera forum	12	12.9
Text message	9	9.7
Skype	9	9.7
Email	9	9.7
Phone	6	6.5
WeChat	5	5.4
Whatsup	2	2.2
Face to face	2	2.2
Other[a]	5	5.4
Total	93	100

[a] Other includes Wiki, Google Hangout, Google +, Twitter, Blog, etc

Qualitative data and data on student perceptions

To better understand our quantitative results, we also interviewed students to explore their experiences while working in groups and to find out what factors contributed to the success

and failure of groups. Ten Chinese participants were recruited to interview, either face-to-face or online. We asked them questions like, "What communication tools did your team use to communicate within your group?" and "Why did you choose to use this tool?"

As seen in Table 26, QQ ranked at the very top of communication tools used in group work. One high school student answered: "I used QQ everyday to chat with my friends and families, and it has a user-friendly interface. It is an instant chatting application installed on my phone and I can chat with my group members whenever and wherever I would like to, it would only take me about one to two minutes to read and reply in Chinese. The members in my group are all Chinese and I can type in Chinese very easily. If I work in a heterogeneous group with people from other countries, and use a tool I am not familiar with, things won't work so well for me. Because firstly I need to get used to the new application, and then I will need to type in English which probably take me forever to finish a sentence, since my native language is not English."

Features of QQ, including easy access, a user-friendly environment, and allowing typing in Chinese, make it the most popular option among the tools used in group work. Although learners were offered various communication tools, the minimal usage of those tools may contribute to the findings of no significant difference in terms of supporting course completion by grouped and non-grouped participants.

Another student who was assigned to the synchronous ad hoc group said:

> Our group used ZOOM (online meeting tool). The first time I logged into ZOOM, I met with several people, and we introduced ourselves to each other and had really nice conversations. However, the second time I logged back into the chatting room, and nobody was there, and I waited for a couple more minutes, and no one showed up so I left. Then I never logged back in again.

Group size, student motivation, communication tool preference, and other factors may affect students' participation in group work participation. Failure to receive or attend to the email in which group assignments were conveyed may also have led to diminished participation in group work.

Another student complained: "I signed up to work in groups, but never received a notification email." At the beginning of the grouping process, we contacted participants through emails—their email addresses were collected through the pre-course survey—and several participants forgot to leave their email address or left invalid email addresses, for instance, typing the wrong domain name, using .co instead of .com. We fixed those obvious email address errors, however, since we had a global audience, and we couldn't fix some of the emails address if they used their company's domain names and typed them incorrectly. Also, some countries blocked our emails, perhaps because they had been identified as coming from abroad and were interpreted as spam emails.

These interview data informed us of three major issues to be considered when choosing communication tools for online learning groups: tool accessibility for the global audience; tool and language preferences across nations and cultures; and the different forms of Internet censorship in different countries, resulting in the blockage of some online programs or communication tools in certain countries.

The post-course survey data also allows us to investigate learners' perceptions of the value of working in groups. Because we created 42 different groups spanning experimental and control conditions and varying in sizes, and because of typically high MOOC attrition rates and response rates to the post-course survey, information provided on the perceived value of groups and their impact on course and assignment completion, should be viewed as informative, but not definitive.

Ninety of the 764 participants completing the pre-course survey completed post-grouping surveys (12 %). As shown in Table 1, these 90 respondents represented 32 groups, which is 76 % of all groups formed. Fourteen of these groups were represented by a single respondent, while 10 groups were represented by two representatives, six groups by 3 to 6 and the two largest groups, the mixed intention asynchronous control group ($n = 108$) and the Ad Hoc Zoom Group ($n = 231$) were represented by 17 respondents (16 %) and 19 respondents (8 %) respectively. Participants representing 17 groups reported that they started meeting within the first 2 weeks of the group assignment.

We classified groups as "successful" or "unsuccessful" based on the majority of responses from each group. As shown in Table 27 below, four of the 30 groups reporting (13 %) were perceived as successful by group members. Of the four successful groups, one was a synchronous group, two were asynchronous groups (one of which had seven respondents, with six calling the group successful and one rating it as unsuccessful), and one was the ad hoc group, which was left to meet spontaneously via a synchronous video and audio chat room. This ad hoc group was represented by six respondents, all reporting that the group was successful.

The groups identified as successful reported having worked with their group for an hour/per week or less; one student from one group (an English asynchronous group intending to complete all assignments) reported longer time spent together. In general, meetings were reported to be less than 30 minutes long, although there were groups that held 60–90 minute meetings. Two of the "successful" groups were asynchronous groups, and they reported corresponding via emails or by posting in the Coursera forums, saying such things as:

> We only corresponded by email and through the forum. This was a good way to share ideas albeit only one person responded.

and

> We did not meet, worked only on message boards or on Facebook as needed.

Table 27 also shows that eight synchronous and eight asynchronous groups reported that their groups had not been successful, representing 67 % of synchronous groups, 47 % of asynchronous groups, and 53 % of all groups. Eight of the 30 groups (27 %) reported that the groups did not meet.

Respondents reported that the factors most directly related to group success were speaking the same language (4 people), having similar interests (3), having similar occupations (2), and the high motivation levels of other group members (2).

Interesting discrepancies in what made groups successful were also observed. In four groups, different members of the same groups perceived their group differently, with some reporting that group was successful, while others felt the group was less successful or unsuccessful. These findings can be explained by different members' experiences. One reported:

> We had no leadership, no direction, no reason for being a group. We never met, and only exchanged a few emails. It was a complete waste of time.

Another member of the same group wrote:

> "I sent out the first email to everyone in the group and set up our Facebook group" and "as needed on Facebook. No formal meetings."

Students who reported belonging to a successful group found their group most helpful in submitting better assignments, but there was little indication that groups were helpful in studying the course content.

Table 27 Post-course survey of learner perceptions of group success

		Perceptions of group success										
		Successful		Mixed successful		Unsuccessful		Mixed unsuccessful		Did not meet		
		Groups	*n*	Groups	*n*	Groups	*n*	Groups	*n*	Groups	*n*	Total Groups
Synchronous Groups	Number	1	1	0	0	8	11	0	0	2	2	11
	Percent	9.1 %	7.1 %	0.0 %	0.0 %	72.7 %	78.6 %	0.0 %	0.0 %	18.2 %	14.3 %	
Asynchronous groups	Number	1	1	1	7	5	45	3	13	6	6	16
	Percent	6.3 %	1.4 %	6.3 %	9.7 %	31.3 %	62.5 %	18.8 %	18.1 %	37.5 %	8.3 %	
Ad Hoc group	Number	1	6									1
	Percent	100 %	100 %									
	Total	3	8	1	7	13	56	3	13	8	8	28[a]

[a] There were two groups with one respondent indicating that the group was successful while one other respondent indicating that the group was unsuccessful. One of these groups was a synchronous group and the other was asynchronous. These groups with balanced, contradictory assessments are not included in this table, but are included in the calculation of percentages of groups responding

Discussion

The main findings of the study are that female learners and learners who intended to complete the MOOC were more likely to want to study in groups than males and people who did not intend to complete the MOOC. We were initially surprised to see that even when given the opportunity to complete the CIC course and participate in CIC MOOC groups in Chinese, almost half of the Chinese learners chose to participate in English, which further research may determine reflects that a second purpose for enrolling may have been to find a venue to practice communicating in a non-native language. Our results also indicated that as the level of proficiency in English increased, preference shifted from synchronous to asynchronous modes of communication, which future research might determine to indicate that new speakers of English may be seeking opportunities to use their new language skills in real-time conversations.

A slight majority (53 %) of CIC MOOC participants preferred to use synchronous (real-time) forms of online communication, and relatively few MOOC learners (15 %) preferred to use video and audio communications. Males (62 %) were more likely to prefer synchronous modes of communication than females (52 %), and as age and education level of the students increased, MOOC learners' preferences for synchronous communication diminished.

In this initial study, assigning learners to groups did not increase learners' probability of completing the course or completing the course with distinction, regardless of whether the group was synchronous or asynchronous. However, it should be remembered that the content of this MOOC was creativity and innovation, and that in MOOCs requiring greater prerequisite knowledge or focused on content of a more challenging nature, group participation may play a more significant role. Course completion was also not significantly related to the highest educational level learners had attained, the number of hours they worked, or to their gender, but course completion was significantly associated with learners' ages when grouped into categories above and below the age of forty. Learners who are 40 years old or older are more likely to complete the course or to complete the course "with distinction".

Previous research on online modes of communication point out that synchronous and asynchronous tools have both facilitated and inhibited cognitive, teaching, and social presence (Rourke et al. 1999). When asynchronous chats and text-based computer conferencing had been used, researchers reported higher levels of social presence in affective, interactive, and cohesive categories (Rourke et al. 1999). In general, asynchronous discussion boards have been preferred for more involved cognitive engagement and cognitive presence. However, although the results have not been consistent synchronous and asynchronous modes have been used for different purposes or to supplement each other (Oztok et al. 2013, p. 90).

Since the synchronous Web 2.0 tools offer more synchronous communication options for free and synchronous modes have been seen to provide a richer social and teacher presence, it has been proposed that synchronous personal messaging "increases the sense of community among class participants and encourages more interactivity" (Oztok et al. 2013, p. 93).

Our study illustrates that meaningful differences in the synchronous and asynchronous mode preferences exist and that these differences are moderated by English proficiency and education level, and also by gender and age boundaries. According to Jensen and Helles (2011), we should expect to see differences in digital media use across education levels,

gender, and age. The perception that asynchronous tools provide opportunities for critical thinking (Tomai et al. 2014) as well as more cognitive involvement and more contributions in traditional online courses (Oztok et al. 2013) might explain the decreased preference for synchronous communication as English proficiency and education level and age increase.

Hashizume et al. (2008) explain the preference of older participants for asynchronous text-based posts as a tendency to stick with the older technologies with which they are familiar. Although they did know enough about technology and were comfortable enough with technology to enroll in a massive open online course, many adults and senior citizens may not be as comfortable with or knowledgeable about newer social media options, and they may not have wanted to invest the time needed to learn to use new tools to participate in a group.

This study was not designed to *explain* the identified differences, and additional research is needed to fully understand the causes of the differences identified. However, there is some relevant evidence that may be useful to guide such research. For example, recent research shows gender differences in mediated communication between men and women. Contrary to previous studies, Kimbrough et al. (2013) report that women highly prefer text-based chats, video chats, and video call-based modes of communication. However, these differences in communication preferences might also be explained by the purposes for which both genders engage in online communication. Women mostly use technology to connect with others, while men use it for "agentic [from agency] means", such as being leaders or decision makers (Kimbrough et al. 2013, p. 898).

Jackson et al. (2001) have found that females reported more computer anxiety and less computer self-efficacy, and Lin et al. (2012) reported that women spend less time with technology and primarily use it for socializing. Women are also reported to be more enthusiastic online communicators (Fallows 2005) and to use more social media than men (Duggan 2013; Lane 2013). In the CIC MOOC overall, 52 % of the learners were male and 48 % were female, whereas in our study, 61 % of the participants (people who signed up to work in groups) were women, and 39 % were men. Based on findings like those reported above, it may be tempting to assume that females may have felt more anxiety when learning online and may have hoped that group participation might improve their chances of success. However, our findings could also be explained by the fact that women are more social and tend to be more facile in communication than males, thus preferring to work in groups. As our study did not investigate causal relationships, more research will be needed to confirm the factors behind higher rates of female participation in this study.

People with higher levels of education (bachelor's degree and above) chose to use text-based posts, i.e., email, course forums, blogs, etc. The medium they chose may be the most frequently used tool at work, such as email or discussion forums they normally use to participate and communicate with others, or the asynchronous nature of these tools might appeal to them because of unpredictable schedules related to work and home life. People with lower levels of education, who were more likely to choose real-time text-based chats, such as instant message or QQ (the dominant Chinese social media tool), may have done so due to the different nature of their job tasks, or due to the relationship between age and education level, as people who have lower levels of education are also likely to be younger and more interested in the social opportunities afforded by synchronous conversations.

Limitations of the study

In interpreting these results, the reader should consider the content of the MOOC and how MOOCs on different topics might produce different results in terms of learners' preferred

modes of communication. The CIC MOOC focused on developing creativity and leading change, and called for experimentation and experiential learning (Jablokow et al. 2014), which may have influenced learners' inclinations to choose a group for study or to remain independent, as well as the mode of communication they felt would be most appropriate for this course in a group setting. Future studies of groups and their preferences in this MOOC should take the impact of the particular content on learners' decisions and preferences into account.

Other factors contributing to learners' media preferences, including personality (Kraaykamp and Eijck 2005) and technology affordances, were not investigated in this study. Because our study worked only with learners who volunteered to be grouped, the participants included many more learners who intended to complete the entire course than one would find in a typical MOOC student body. For this reason, the results of this study should not be considered representative of the entire population of MOOC learners, and seen as appropriate for grouping ***all*** MOOC learners, without regard for the desire to be grouped. Future research might incorporate measures of other variables in order to shed light on the origins of the differences that exist. Although this study placed learners into groups, informed them of group assignments, and encouraged them to work together, this study stopped short of scaffolding groups and monitoring group interactions. Future research should include a more powerful intervention designed to help learners form productive groups, perhaps using the framework proposed by Slagter van Tryon and Bishop (2009), and should monitor groups to understand what they did in order to better understand the potential of grouping in MOOCs.

Conclusion

As noted by Slagter vanTryon and Bishop (2009), "in learning online, where communication is computer-mediated, students new to the learning environment may be unfamiliar with communication channels. As a result, it may be necessary to increase the quantity and quality of online social interactions in order for a group social structure to develop" (p. 304). Because forming student groups has the potential to overcome some of the limitations of MOOCs and to improve learning and persistence in such courses, educators who design and implement MOOCs should know about the relationships among certain learner attributes and online learners' preferred modes of communication. An immense amount of time and effort is required to collect and analyze the data from thousands of learners at the beginning of each course. Information like that shared above can be used as baseline data upon which grouping decisions can be made, and upon which grouping processes might be automated, to better serve the large MOOC populations and to increase students' online presence in MOOCs, as discussed by Rourke et al. (1999).

This research studied CIC MOOC learners' preferred modes of communication and how these preferences are different based on students' level of English language proficiency, gender, level of education, and age, and did so in the context of a MOOC on creativity and innovation. The content in this MOOC may not have generated as much confusion and may not have called on prerequisite knowledge to the same extent that MOOCs on other topics would have, and for this reason may not have inspired the same level of group participation that might have been produced in a MOOC with content that produced the need for more peer-to-peer support, so research with other forms of content may find greater levels of group participation and more value as a result of it. However, the findings related to

grouping preferences, which were collected at the beginning of this MOOC are likely to have more general implications spanning MOOCs on different topics, and are important considerations to keep in mind when designing support structures for online courses and MOOCs, particularly when group assignments, projects, and/or other learning activities are present. In addition, we hope that a better understanding of these factors will help encourage group learning within online environments, thereby increasing retention and improving learning outcomes.

This study also conducted a preliminary investigation into the value of assigning MOOC learners to groups and introducing them to group members, a time-consuming task, but one that might be able to improve MOOC completion rates. We discovered that, given this content area and without providing additional guidance to group members, there is no benefit from grouping MOOC learners. Grouping alone is not enough. However, if groups are given more formal guidance and perhaps roles to play in the group's work, future research may prove grouping to be an important enhancement to MOOCs, which may prove to strengthen the peer-to-peer engagement in the absence of meaningful input from an involved instructor.

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