Talkabout: Making Distance Matter with Small Groups in Massive Classes

Chinmay Kulkarni[1], Julia Cambre[1,2], Yasmine Kotturi[3], Michael S. Bernstein[1], Scott Klemmer[3]
[1]Stanford University, [2]Coursera Inc., [3]UC San Diego
{chinmay,jcambre}@cs.stanford.edu, ykotturi@ucsd.edu, msb@cs.stanford.edu, srk@ucsd.edu

ABSTRACT
Massive online classes are global and diverse. How can we harness this diversity to improve engagement and learning? Currently, though enrollments are high, students' interactions with each other are minimal: most are alone together. This isolation is particularly disappointing given that a global community is a major draw of online classes. This paper illustrates the potential of leveraging geographic diversity in massive online classes. We connect students from around the world through small-group video discussions. Our peer discussion system, Talkabout, has connected over 5,000 students in fourteen online classes. Three studies with 2,670 students from two classes found that globally diverse discussions boost student performance and engagement: the more geographically diverse the discussion group, the better the students performed on later quizzes. Through this work, we challenge the view that online classes are useful only when in-person classes are unavailable. Instead, we demonstrate how diverse online classrooms can create benefits that are largely unavailable in a traditional classroom.

AUTHOR KEYWORDS
Online education; peer learning; culture; reflection

ACM CLASSIFICATION KEYWORDS
H.5.3 [Group and Organization Interfaces]: Computer-supported cooperative work

INTRODUCTION
At their best, culturally diverse classrooms leverage students' different backgrounds to improve learning and foster cultural understanding. When students engage with peers from different cultures, they become aware of their own assumptions and how others have different perspectives [39]. This shifts students from 'automatic' thinking to more 'active, effortful, conscious' thinking, which aids learning and growth [19]. But, while physical classrooms often strive to be diverse, they remain limited by physical geography [31].

Massive online courses recruit thousands of students from over 100 countries, bringing together peers with many nationalities and experiences [44]. Instructors often advertise how many countries are represented in the class [5, 30, 44]. However, while student diversity has become a calling card of online education, this potential is currently untapped. Most online students currently see only a glimpse of their peers' global diversity, primarily in text discussion forums. This slow-motion communication is a poor fit for the open-ended dialogue characteristic of dorm hallway conversation [28], and can reinforce a one-size-fits-all, broadcast educational approach [34].

This paper illustrates the potential of leveraging diversity in online classes, and introduces the Talkabout environment and curricula for small, geographically-diverse groups in massive classes. Talkabout connects students to their global peers via guided, synchronous video discussion. Talkabout focuses on harnessing *geographic diversity*, where students connect with peers from other parts of the world. Geographic diversity enables students to access peers with different cultures [17], levels of income [16], and beliefs about learning [48].

Geographically diverse classrooms can improve educational experiences, making them deeper and more realistic. Multinational discussions create the opportunity for what one student called a 'mini United Nations', where students experience first-hand the differing concerns and beliefs of people from different countries.

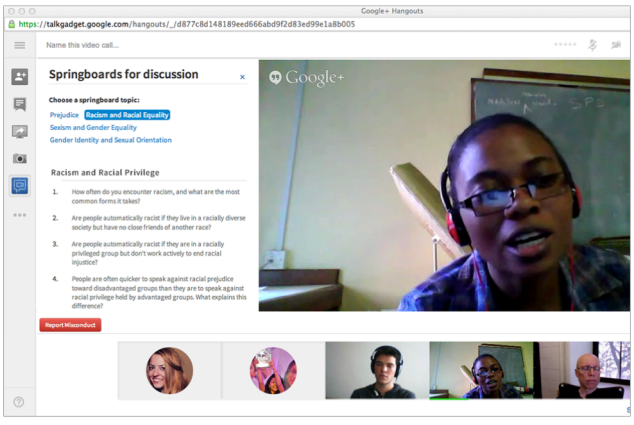

Figure 1: Talkabout provides a structured discussion agenda and enables students from around the world to discuss with each other.

CSCW 2015, March 14–18, 2015, Vancouver, BC, Canada.
ACM 978-1-4503-2922-4/15/03.
http://dx.doi.org/10.1145/2675133.2675166

Course Title	Representative Discussion topics
Critical Perspectives on Management	How do you define innovation and invention? How do manage them? Are shipping containers and labor unions innovations or inventions?
Irrational Behavior	How do you treat money as a relative rather than absolute good? Do you think that it is more painful to pay with cash than credit? How might issues of fairness vary by culture?
Organizational Analysis	Describe your experience in organizations where decisions by organized anarchy occurred. Did they solve anything? How common were they?
Social Psychology	In your country, which forms of prejudice are the most socially acceptable, and which ones are the least acceptable? Why are some forms more acceptable than others?
Think Again	Since inductive arguments are defeasible, how can it ever be reasonable to trust them? Are arguments from analogy really different from inferences to the best explanation?

Table 1: Excerpts from discussion agendas from one week in different classes. Each question below included more detailed guidance in the actual discussion

Talkabout forms groups of two to nine students from different parts of the world for a video discussion. Discussion prompts ask peers to relate course content to their local and personal experiences, encouraging students to reflect on previously unexamined assumptions about their own environments, and deepening their learning [33]. To date, more than 5,000 students from 134 countries have used Talkabout in fourteen online classes via Coursera and OpenEdX. This paper reports results from the first seven courses and 3,200 students. These classes included Social Psychology, Organizational Analysis, Behavioral Economics, and Logic and Design. Table 1 shows a sampling of topics discussed. The median discussion had six students from five countries.

Talkabout's discussion sessions improved student engagement: students randomly assigned to a Talkabout group were significantly more likely to participate in class quizzes than those placed on a wait-list for future participation (Wald $z^*=1.96$, $p=0.03$).

Geographically diverse discussions yield higher grades and engagement. A controlled experiment in two massive online classes varied the number of countries present in Talkabout discussions. Students in more geographically diverse discussions performed significantly better on subsequent quizzes and exams ($t(129)=1.78$ and $t(110)=2.03$, $p<0.05$).

Some argue that online education is only desirable when face-to-face education is unavailable [15]. This paper illustrates the benefits of inverting this proposition: global diversity enables online classrooms to create powerful, previously unavailable educational experiences and new forms of peer education at scale that go "beyond being there" [25].

RELATED WORK

A tremendous benefit of diverse classrooms is that students of differing gender, ethnicity, and ability have opportunities to interact. When people interact with similar peers, their shared background leads to automatic thinking. In contrast, interacting with diverse peers often creates a discontinuity [19] that unearths hidden assumptions—yielding more active, effortful and conscious thought [9]. This active and effortful thinking improves academic performance and makes students more inclusive and democratic [19].

Travel, and interacting with geographically diverse people, similarly induces active thinking and reflection [33]. For instance, study-abroad programs result in deeper knowledge and understanding—especially about culture and international affairs—and greater self confidence [4].

The benefits of interacting with geographically diverse peers arise from differences in experiences and thinking. Examples of these differing experiences include stark differences in population density, income and educational systems [56]. People from different parts of the world have different cultural values, reasoning, and preferred learning methods. For instance, cultures differ in their emphasis of individuality versus interdependence [22, 36] and holistic versus analytical thinking [57]. These differences impact cognition. For example, when cultures encourage people to consider objects in relation with their context, they more often apply analogical thinking. By contrast, when people consider objects in isolation, they more often apply categorical rules [57].

To maximize the benefits of diversity, prior work emphasizes two factors: the numeric representation of diverse groups *(structural diversity);* and the number of settings that students interact in (*experiential diversity)* [27]. Ideally, students must meet frequently, and with equal status, in situations where collaboration is necessary and stereotypes are disconfirmed [47], and where differing views are welcomed [23].

Informed by this research, Talkabout forms geographically diverse discussion groups, and encourages fluid roles and consensus-based decisions that emphasize equality. Furthermore, Talkabout contributes a curriculum where students can question stereotypes and compare their views to their peers.

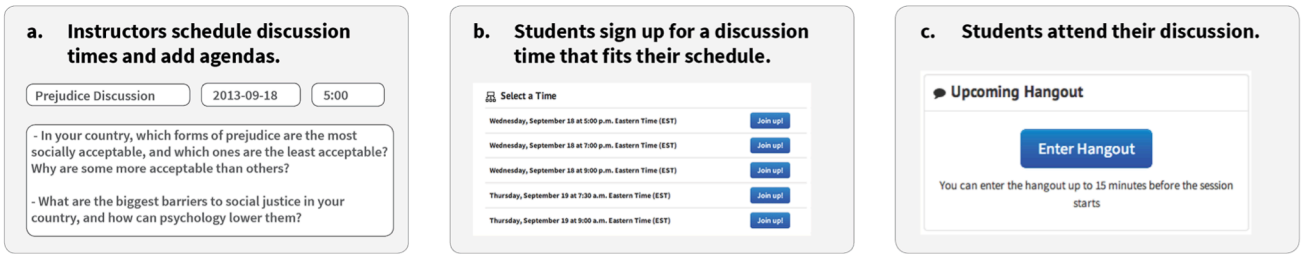

Figure 2: Talkabout discussion timeline: (a) Instructors enter a discussion agenda, and times for the discussion. (b) Students pick their preferred time. (c) When they log on to Talkabout at their selected time, Talkabout assigns them to a group, and creates a private hangout. (c) Students show up at their selected time, and enter the discussion.

In most current online classes, students' opportunities for discussions with diverse peers are limited to text-based forums. Such asynchronous text channels inhibit trust-formation [49] and open-ended discussion [52]. Synchronous channels, such as video, improve participants' sense of belonging and willingness to collaborate [50]. Channels such as video which support multimodal communication and nonverbal cues are also better suited to ambiguous discussions [11] and complex sense-making [13]. For these reasons, Talkabout leverages synchronous, small-group video discussions to encourage meaningful, open-ended dialogue.

Massive scale presents both a formidable challenge and a powerful opportunity for online education. Prior work encouraging unstructured discussion failed to find an improvement in students' sense of community or academic achievement [8]. More systematically structured approaches have enjoyed greater success. One example is the use of rater redundancy and short exercises that create micro-expertise in peer review: with this structure, peers can provide expert-quality assessment and feedback [32], and act as mentors [45]. Talkabout introduces a structured interaction and curriculum that leverages diversity.

COORDINATING GLOBAL SMALL-GROUP DISCUSSION

The Talkabout interface guides instructors through setting up their course discussions, and creating a structured discussion agenda for students (Figure 2a). This agenda is displayed throughout the discussion (Figure 1).

Students choose a discussion time from the published set (Figure 2b), up to a week in advance. As students log in at their selected time, Talkabout assigns them to groups (instructor can choose group size between 2 and 9). Talkabout has several policies for group assignment; by default it assigns arriving students to a group until it reaches its size limit; then it starts a new group. Other policies, discussed later, explicitly factor geographic location into group assignment. Discussions occur through the Google Hangouts platform for multi-person video and audio chat. For each group, Talkabout creates a discussion session exclusively for the assigned participants. Discussion groups exist only for the duration of the discussion session. If students participate in multiple discussion sessions—even in the same course and on the same topic—they are likely to have different partners, because grouping depends on students' arrival order. Consequently, students hear different ideas and experiences each time.

During discussions, the Talkabout Hangout application shows the instructor's discussion agenda on the left and the video chat on the right. An agenda typically includes suggested discussion topics or activities (Figure 1, Figure 4).

ASSIGNMENT BY ARRIVAL YIELDS DIVERSE GROUPS

To quantify the geographic diversity in discussions, we aggregate countries into eight geographical regions, and

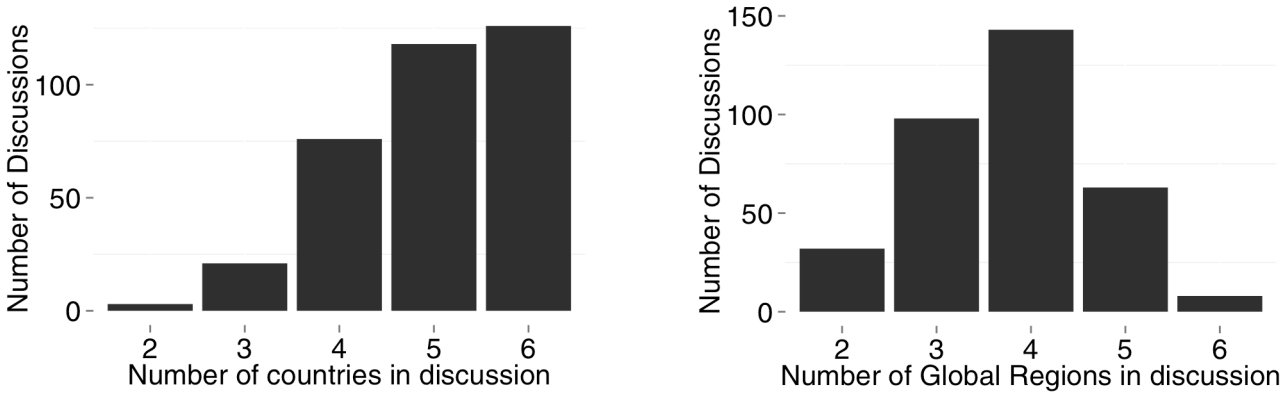

Figure 3: Across classes (a) Students from many countries participate in each six-person discussion (b) These students aren't just from neighboring countries, they are globally distributed.

count the number of regions in each discussion. Five regions are from the World Bank's classification [18]: *Eastern Europe and Central Asia* (primarily the former Soviet bloc), *East Asia and Pacific* (mainly China, Japan, Korea, and South-east Asia), *South Asia* (mainly the Indian subcontinent), *Latin America and the Caribbean* (Americas except the US and Canada), *Middle East and North Africa*, and *Sub-Saharan Africa*. The World Bank only classifies middle- and low-income countries, so we added three other regions: *North America* (US and Canada), *Western Europe*, and *South Pacific* (primarily Australia and Polynesia).

Across seven classes and the first 3,200 participants, allocating six-person groups by arrival order yielded discussions with a median of four global regions (Figure 3b), and a median of five countries (Figure 3a). The median pairwise distance between discussants was approx. 6,600km (4,100 mi): more than the distance between New York and London.

STRUCTURING TALKABOUT DISCUSSIONS

Our early experiences with Talkabout, as well as prior work, suggest that it is critical to co-design curricular strategies with educational interaction design. In particular, scripts for discussion have a major impact on student engagement and learning [42]. Talkabout succeeds best when discussions create opportunities to highlight students' diverse experiences. Based on prior work, we developed three strategies to create discussion scripts or agendas, and refined them through deployments in seven massive classes. Figure 4 shows these strategies embodied in an excerpt from an *Irrational Behavior* agenda (the complete agenda is in Supplementary Materials). We discuss each strategy in turn.

Create opportunities for self-reference

Self-reference, when students actively relate class content to their own experiences and perspectives, increases concept elaboration, memory organization, and knowledge retention [54]. Talkabout agendas that employ self-reference ask students to share personal examples that embody class concepts. Self-reference is especially effective when students feel safe in discussing personal experiences. Talkabout groups are small by design to encourage self-disclosure [40]. As each person shares with the group, it encourages peers to likewise disclose [29].

The globally distributed nature of discussions amplifies the benefits of sharing self-referential frames. After a discussion on prejudice in Social Psychology, one student wrote, "I think this may have been the first time the lady from Saudi Arabia had spoken to a Jew [referring to himself]", showing her a different viewpoint. He added, "I told her about the prejudice from Christians I experienced growing up in [US state] in the 40's and the effect of segregation on blacks," reflecting on his own experience.

Students may see different self-referential frames with different groups. For instance, even though Social Psychology had only one Talkabout discussion (with multiple slots), 454 out of 2,553 participants in the Social Psychology class voluntarily attended multiple timeslots.

Highlight viewpoint differences using boundary objects

Talkabout prompts aim to make the differences between students' perspectives salient. This encourages additional self-reference and re-evaluation of previously held theories, which in turn leads to deeper understanding [20].

To highlight differences, Talkabout discussion agendas call out boundary objects across geographical contexts. Boundary objects are objects or concepts that maintain their integrity across communities, and yet can be interpreted differently in different communities [53]. Everyday concepts, such as governments, companies/organizations or current events can serve as boundary objects. For instance, one student noted how discussing a 'recent event' yielded new perspective: "we were … joined by [a] Syrian. She provided…insight of the situation in Syria and how the media is exaggerating it… and how the society was quite liberal on Islamic practices (such as wearing the hijab)."

Leverage students as elaborators and mediators

When a prompt says less, students sometimes say more. Rather than reviewing every relevant concept, Talkabout discussion agendas reference concepts from class without any reminders of what they mean. These underspecified references lead students who have learned these concepts to elaborate, and to act as mediators with students who would

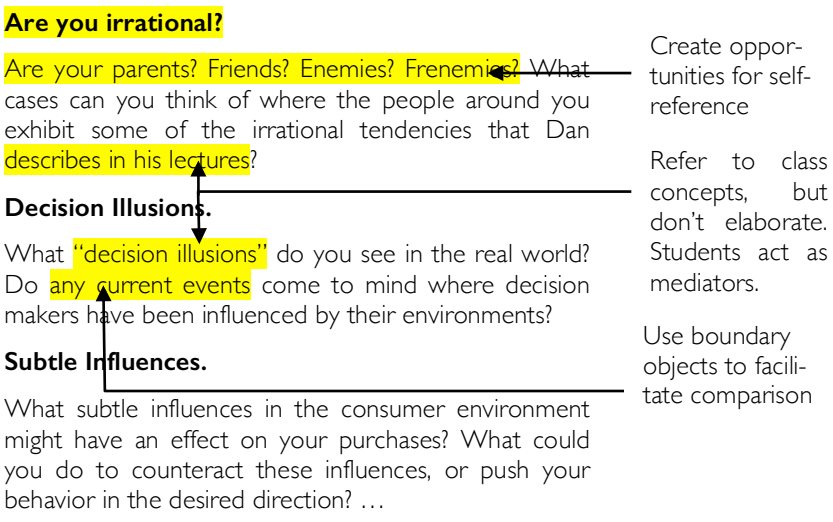

Figure 4: Excerpt from discussion agenda in an Irrational Behavior discussion, showing examples of discussion-structuring strategies (highlighted)

have otherwise not understood them. This is similar to highly effective offline strategies like jigsaw classrooms, which also rely on peer-mediated learning and contact with dissimilar peers [2].

Creating opportunities for mediation also encourages students to ask about other class concepts they haven't understood. For instance, the Organizational Analysis class used "white flight" (a large-scale migration of white Americans to suburbs in the 1950s) as an example of an organizational problem faced by cities. In one Talkabout discussion session, we observed an American student translate the key ideas in this example to a European classmate by making an analogy to intra-European migration.

THE ANATOMY OF A TALKABOUT DISCUSSION

What is the nature of a Talkabout discussion session? We observed and recorded twelve Talkabout discussion sessions in *Organizational Analysis*. An abridged transcript from an Organizational Analysis class is in Supplementary Materials. Talkabout discussion sessions followed a pattern with clear roles and norms.

Discussions follow a distinct conversational pattern

Talkabout discussion sessions usually began with introductions. Since none of the participants knew each other, introductions were fairly formal and detailed. Participants typically shared their first name, their country of residence, and a brief description of their job. Because some participants arrived late to their session, this introduction phase was often repeated.

During these introductions, an informal moderator usually emerged. Moderators often had experience with video-conferencing and a high-bandwidth connection. They exhibited leadership behaviors such as asking participants to introduce themselves, or even explicitly asking to moderate the conversation (e.g. "Shall I lead the conversation?")

After introductions, the informal moderator drew the group's attention to the instructor-provided discussion agenda. Even though agendas sometimes suggested a particular discussion order, participants did not follow it exactly. Instead, they would interpret the agenda for the major theme it embodied, and negotiate what they discussed first. Once students finished discussing a particular prompt, they returned to the agenda to decide the next topic.

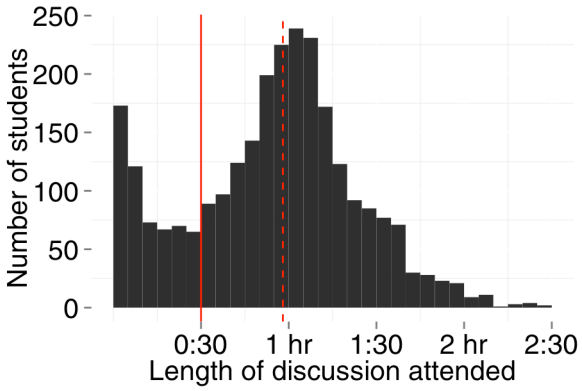

Figure 5: Across classes, students participated in discussions much longer than instructions indicated. The solid red line is the recommended duration for discussion (30 min), the dashed line is the median discussion time (58 min).

While Talkabout discussion sessions were designed to last 30 minutes, the median length of the discussion was 58 minutes (Figure 5). With these longer discussions, students discussed topics that were marked optional, or chose to discuss two topics when the agenda asked only one etc. Many groups also spoke about the class in general after the assigned topics. Conversations typically ended soon after the informal moderator (or a talkative speaker) left the discussion, or when no one in the group suggested a topic to discuss next. As they left, participants often shared how they enjoyed talking to the group, or taking the class. Moderators sometimes encouraged the group to stay in touch after the discussion (e.g. "With the other hangouts, we all added each other on LinkedIn… I've already added [name]. If you'd like, feel free to add me.")

Speakers and Spectators

Students seemed to decide early on whether they primarily wanted to speak during the discussion ("speakers"), or listen to the discussion ("spectators"). Spectators often signaled their intent by muting their microphones (this showed a "mic muted" icon to others in the discussion).

Speakers tended to be native English speakers or have faster Internet connections. Their discussion was conversational, with overlapping turns similar to face-to-face conversation. Spectators spoke less frequently with longer non-overlapping turns, but were not passive participants. When spectators had trouble finding the right words (e.g., if they were non-native speakers), speakers often suggested words, or encouraged them to continue.

Participants with low-bandwidth connections generally assumed the spectator role and often used the text chat feature in the Google Hangout to "speak" in the discussion. Speakers (usually the moderator) would notice the text, and speak it aloud to the other participants. Both speakers and spectators used text-chat to demonstrate active listening without interrupting the speaker via audio (for example, a student wrote, "Working in [company] must be really cool. Thanks for sharing :)").

A shared video channel forces a single conversation. Still, students sometimes used text-chat as a way for non-discussion related talk, such as exchanging contact information or LinkedIn profiles.

STUDY 1: DO DISCUSSIONS HELP PERFORMANCE?

It is not obvious that the benefits of peer discussions [6, 46] would transfer to an online environment. In these environments, peers have vastly different backgrounds and no prior interaction with each other. Therefore, our first study

measures the benefits of participation in online discussions. Later experiments measure how these benefits vary with geographic diversity in discussion groups.

With many educational practices, it is difficult to draw a causal link between participation and student learning. For instance, students may self-select to participate. To combat this bias, we use a control condition in which interested students are actively prevented from discussing. Furthermore, we use an *intention-to-treat* analysis that recognizes that some students will not participate, even when given the opportunity. Therefore, this analysis asks: after controlling for students that don't discuss given an opportunity, are discussions effective? Such analysis is common in clinical trials, where patients that are randomly assigned to a treatment group are included in the analysis even if they do not take their medication. Because intention-to-treat analyses take non-compliance into account, they result in conservative estimates of a drug's effectiveness.

Method: wait-list control

In a between-subjects experiment, we randomly assigned students in the Organizational Analysis class on Coursera to either a *Discussion* condition, or to a *Wait-list* condition. This assignment occurred when they signed up for a discussion time on Talkabout, after consenting to participate in the study.

Students in the Discussion condition were allowed to participate in discussions starting in Week 1, while those on the wait-list were not allowed to participate in discussions until Week 5. This setup results in two discussion opportunities (Week 1 and Week 3) where a subset of students was prevented from participating. Even though some participants in the Discussion condition did not attend discussion, they were included in the intention-to-treat analysis.

Hypotheses and Measures

We hypothesized that participating in a Talkabout discussion session would motivate students to engage with other course components. Prior work similarly finds that discussions motivate students to engage with in-person classes [6]. To measure engagement, we check whether the student participated in the course quiz due the day after discussion. Recall that participation in MOOCs is entirely voluntary, and several classes have battled with attrition [24]. Quizzes are a high-effort activity that most MOOC learners don't participate in: only 22.8% of students who watched a lecture video also participated in a quiz. This makes quizzes suitable as a high-effort engagement measure [8, 55].

We further hypothesized that students in the Discussion condition would do better on the quiz, aided by the self-reference, reflection and revision of class concepts.

Participants

Overall, 1,002 students were assigned to the Discussion condition, and 122 to the Wait-list condition. We used an unbalanced design to maximize the number of students who benefited from discussions. Of those in the discussion condition, 397 attended a discussion.

Results: Discussion increases class participation, marginally improves grades

Students in the Discussion condition were more likely to take the quiz. A logistic regression indicated that odds of taking the quiz were 1.46 times higher for the Discussion condition (Wald $z^*=1.97$, $p<0.05$). Students in the Discussion condition also did marginally better on the quiz ($t(1122) = 1.89$, $p=0.06$)[1]. The average improvement was 16.7%.

Thus, even accounting for students who do not follow through, discussions help students stay engaged in the course and perform better on related assessments.

While Talkabout participation improves engagement, this effect seems short-lived. Students who participate in a Talkabout one week are not more likely to participate in the quiz the following week: Wald $z^*=1.61$, $p=0.10$. We also found no significant improvement in quiz scores for the quiz due the following week.

Would participating in multiple Talkabout discussion sessions improve these short-term benefits? As is typical with online classes, many students shopped the first weeks, and only 113 students in the discussion condition attended the second discussion (397 attended the first week). Therefore, our intention-to-treat analysis lacks the statistical power to capture any benefits of participating in multiple discussions. Also, while the wait-list design can control for intent to participate, students who actually participate in discussions may still differ from those who don't (e.g. they could be more motivated). An intention-to-treat analysis estimates effects by assuming participants' distribution (e.g., for motivation) are similar in the wait-list and treatment groups due to randomized assignment, but this experiment does not verify this assumption.

The results of this study suggest that performance on class quizzes may improve even with limited participation, and that discussions improve student engagement. Do these effects depend on the participants in the discussion? Given our hypothesis that geographic diversity should help learning, our next study investigates the effect of discussants' geographic diversity on course performance.

STUDY 2: DOES DIVERSITY HELP PERFORMANCE?

Study 1 established that participating in Talkabout discussions improves class engagement. Is geographic diversity causing this effect? In a second, between-subjects experiment, Talkabout's group-assignment algorithm randomly assigned students either to a single-region group or a multi-region group. Participants regions were determined by the

[1] While only marginally significant ($p<0.10$), we include this result because it is suggests opportunities for future work.

five World Bank regions, as well as three regions to capture North America, Western Europe and the South Pacific. The *Same-region* condition grouped students with others from their region. The *Multi-region* condition grouped students from anywhere in the world. We discarded data from the South Pacific region because it had few participants.

Participants and setup

55 students in the Organizational Analysis class participated. When students logged on to the site, we recorded their IP address, found their location based on IP, and randomly assigned them to the Multi-region high-diversity or the Same-region low-diversity condition. Students were then grouped into discussion groups with a maximum of six participants.

Measures

To measure conceptual understanding, we invited students to fill out a questionnaire immediately after the discussion; 43 participated. We asked students to answer to the best of their ability, but informed them that their answer would not affect their course grade. This survey had one open-ended question which required critical thinking and an understanding of concepts discussed in the session ("Where would you want to position yourself if you wanted leverage over the flow of "information" in a social network—centrally, peripherally, or in a bridging position. Why?"). We scored this question in consultation with the teaching assistant of the course. The average score was 47% (combining both conditions). We use students' grade in a prior class quiz as a measure of prior performance (we ignore data from one participant, who did not complete the quiz). The questionnaire also asked questions about how much they liked their discussion, and how much they felt they learned from it.

Hypothesis

Students in the Multi-Region, high-diversity, condition were exposed to more contrasting viewpoints and self-reference than discussions in low-diversity groups. Thus, we hypothesized that members of more geographically diverse groups would have higher scores on the post-questionnaire.

Manipulation check

The median number of countries in the same-region condition was two (both from the same geographical region), while the median in the multiple-region condition was 4.

Does large geographical distance imply a diverse group? Some World Bank regions are large, so we examined if multi-region groups had more differing national viewpoints than same-region groups, taking into account how economic opportunities and educational experience influence everyday experience [12], as do cultural values [36].

We used each participant's country to map them onto diversity attributes used in cultural psychology and political science. We use countries as our unit of analysis because they have a consistent typology of collectivistic or individualistic culture [17], organizational attitudes such as interpersonal dependence and criteria for fulfillment [51], economic development [16] and life expectancy [37]. While each country is diverse, within-country differences are smaller than between-country differences [17], making this by-country analysis feasible.

We compared countries of participating students on three dimensions: cultural values, income, and pupil-teacher ratios in primary school. As a measure of cultural values, we used the mean overall secular values for each country from the World Values Survey [59]. Countries with lower scores have societies that emphasize religion, traditional family values, and collectivistic thinking. The average pairwise difference between participants' countries on the overall secular values scale was lower in the same-region condition than in the multi-region condition, Wilcoxon W=407.5, $p<0.05$ (*same-region* mean: 0.022, equivalent to the difference between the US and Romania, *multi-region* mean: 0.031, equivalent difference: US and Thailand).

Students' countries in the *Multi-region* condition had marginally higher differences in income levels compared to those in the *Same-region* condition ($t(74)=1.81$, $p=0.07$; log-transformed because income distribution is log-normal [7]). Using data from the World Bank [18], the median per-capita annual income differed on average by $8,120 (PPP) in the *same-region* condition, approximately the difference between the US and Canada. The average difference in the *multi-region* condition was $20,495 (PPP), approximately the difference between the US and Israel.

Lastly, students' countries in the multi-region condition had greater pairwise variation in educational experience, as reflected in primary school pupil-teacher ratios ($t(74)=2.00$, $p<0.05$). Using World Bank data [18], the median differences in the pupil-teacher ratios in the same-region condition were 2.91 (approximately the difference between schools in the US and Canada), while the median difference in the multi-group condition was 5.91 (the difference in schools between the US and Russia).

Collectively, these analyses suggest that multi-region groups brought more diverse experiences and backgrounds to their discussions.

Results: Students in diverse groups perform better

On a 7-point Likert scale question, students in the *high-diversity* condition rated their discussion as more enjoyable than those in *low-diversity* (Mann-Whitney U=140.5, $p < 0.05$). They also reported learning marginally more from their discussion partners on a different 7-point Likert scale (Mann-Whitney U=160.5, $p = 0.08$).

Based on the grades in the post-quiz, an ordinary-least-squares linear model showed that after controlling for prior performance, students in the *high-diversity* condition outperformed those in the *low-diversity* condition, ($\beta=0.41$, $F(1,37)=2.31$, $p<0.05$, adjusted $R^2=0.11$). A post-hoc comparison also found that students in discussions with more

countries did better in both conditions. Using an ordinary-least-squares linear model, we found that the number of countries in the discussion was predictive of the quiz score (β=0.15, $F(1,36) = 2.57$, $p<0.01$, adjusted R^2= 0.14).

This result suggests that even countries in the same geographical region add meaningful diversity. This may be because regions are too large and diverse (e.g. the *Latin America and Caribbean* region has 35 countries). Therefore, counting countries rather than regions may provide a better measure of diversity.

However, this experiment only measures the immediate effects of diversity in a single class. Do geographically diverse discussions have a longer-term effect, and do these benefits generalize across classes? We now describe a longitudinal deployment that evaluates the effect of diverse discussions on grades in actual course tests over periods of weeks.

STUDY 3: LARGE-SCALE FIELD EXPERIMENT

In Study 3, we sought to confirm and expand upon Study 2's diversity effect across more classes and with more students. In doing so, we trade off some of Study 2's experimental control in exchange for a much larger sample. We conducted our experiment across two large online classes, Organizational Analysis and Social Psychology.

Participants

In the Social Psychology class, 2,025 students participated. In the Organizational Analysis, 397 students participated.

All students in the Organizational Analysis class who wanted to participate in discussions used Talkabout. By the instructor's request, the Social Psychology class also allowed students to choose an in-person discussion instead. In-person discussants received the same discussion agenda and directions as online discussants. 2,037 students reported participating in an in-person discussion. Except for qualitative comparisons between online and in-person discussions, we ignore their data. It is possible that online discussions attracted students who believed they would benefit more from a diverse discussion. However, the main results of this study were consistent across both classes.

Method

Similar to Study 2, Talkabout grouped students into discussions. However, students were not explicitly grouped into high- and low-diversity conditions. Instead, this study used a simpler approach where Talkabout collected participants in order of arrival. When a group had six students, Talkabout launched a new group. This setup assigns participants to diversity levels in a random fashion. Participants in both classes had no control over who their discussion partners were, and therefore had no control over the level of geographic diversity in their discussion.

The two classes implemented different schedules for their discussions. Social Psychology held discussions for one week at the end of class, two weeks before the final exam. Organizational Analysis had discussions throughout the class, starting from the first week. This variety allows us to understand the effect of Talkabout both for highly motivated students who remain active at the end of class, and for enthusiastic, but potentially uncommitted learners.

Hypotheses and Measures

We hypothesized that participating in more geographically diverse Talkabout discussions would lead to better course performance, as students became more active thinkers through conversations with diverse students. In addition, given our results in Study 1, we hypothesized that students in more diverse discussions early in the class would stay engaged with the class for longer.

To measure *geographic diversity*, we use the number of countries in a discussion as a coarse but useful metric. While students using Talkabout may be systematically different from the median resident of their country (they can afford an Internet connection), national cultures still importantly shape their thoughts and actions [21].

To measure *performance*, in Social Psychology, we used the final exam score. The final exam was a 50 multiple-choice question test (see Appendix 2 for a sample of questions). The instructor created this exam independently with no input from the research team. The Organizational Analysis class had weekly quizzes due every Sunday, which we use as a performance measure. The instructor independently created these quizzes in a previous run of the class (before Talkabout was designed), and they were used unchanged in the experimental class. The first Talkabout session was one day before the first quiz was due. We analyze the first two weeks' quizzes. The first quiz had 19 multiple-choice questions; the second had 16 (see Appendix 2). Finally, both classes invited students to participate in a post-discussion survey about their experience.

Analysis procedure

For both classes, we built an ordinary-least-square linear regression for performance based on the number of countries in the discussion. Because the number of discussants and number of countries is collinear (R^2=0.81 and 0.88 in the two classes), we only analyzed groups of six students. We controlled for each student's prior performance in class if any previous quizzes had occurred. Our model for the first week's quiz in Organizational Analysis had no measure for prior performance (model R^2=0.003). The model for the second quiz (R^2 = 0.11) used the score in the first quiz as a prior-performance metric. The model for the Social Psychology class (R^2=0.05) used a student's total grade in all assignments before the final exam as a prior-performance metric.

Results

Our analysis finds support for the first hypothesis: students perform better on tests after a more geographically diverse discussion. We find no support for our second hypothesis that diverse discussion improves retention in the long-term.

High-diversity discussions improve scores

In both classes, more diverse discussions led to higher exam grades (Table 2). In Social Psychology, on the final exam out of 50 points, each additional country adds an approximate β=1.78 points (2.4% of the final grade) to a student's final exam score (t(129)=1.78, *p=0.01*). In Organizational Analysis, on the Week 2 quiz out of 16 points, each additional country yields β=0.39 points (3.6%) to the quiz score (t(110)=2.03, *p<0.05*). However, from the model for the Week 1 quiz (without a prior-performance measure), we do not see any significant effect of diversity on score. Prior performance helps capture sufficient variation to make diversity statistically distinguishable from a null hypothesis.

Benefits of diverse discussions last roughly two weeks

In the Organizational Analysis class, while geographic diversity leads to better quiz scores one week after discussion (Week 2 quiz), we did not find any significant effects into Week 3. Similarly, we built an ordinary-least-squares linear model for predicting how many weekly quizzes a student would participate in, based on the number of countries in their first discussion. We found no significant effect (t(130) = -0.49, $R^2 < 0.001$). Similar to results from Study 2, this suggests that the benefits of a diverse discussion only persist for a short duration.

Geographic diversity leads to new perspectives

Post-discussion, a survey asked participants about the best part of their discussion. Two independent raters coded 100 responses about whether comments mentioned participant diversity: 51% mentioned it (Cohen's **κ** =0.7, z=7.04, *p< 0.001*). Students noted that diversity yielded different experiences and examples and perspectives, which challenged ones held by students. A Social Psychology student wrote how they learned that "…in China it is a custom for married women to keep their surnames, thus I [now] think women changing their surnames when married in other countries has something to do with sexism." An Organizational Analysis student said, "It was interesting to hear about organizations in Australia, Ukraine, Israel, Indonesia, and Canada. Similar issues appear everywhere regarding decision-making"

	β	F	p-value
Organizational Analysis: Week 1 Quiz (R^2 = 0.003)			
Intercept	15.7	21.51	**<0.001**
Number of Countries	0.11	0.76	0.46
Organizational Analysis: Week 2 Quiz (R^2 = 0.11)			
Intercept	8.11	4.33	**<0.001**
Week 1 grade (z-scored)	0.78	2.81	**< 0.001**
Number of countries	0.39	2.03	**0.02**
Social Psychology: Final Examination (R^2 = 0.05)			
Intercept	27.20	7.00	**<0.001**
Pre-final grade (z-scored)	0.91	1.30	0.19
Number of countries	1.78	2.34	**0.01**

Table 2: After controlling for prior performance, more countries in a discussion lead to better grades, in both Social Psychology and Organizational Analysis.

Gender representation does not influence scores

In prior work, the proportion of females participants affected collaborative group outcomes [58]. However, in our study, female participation did not affect performance after controlling for the number of countries in each group. Adding the proportion of female participants to the Organizational Analysis class model for the Week 2 quiz did not improve model fit, and the effect of gender was not significant: t(100)=1.1, *p=0.26*. The Social Psychology class shows a similar non-significant effect: t(128)=0.62, *p=0.53*.

Other non-significant factors

We test the following variables in isolation; all were non-significant with *p>0.50*. We found no significant effect of the arrival order of participants on either the diversity in their group, or the benefits of diversity on course grades. We also find no evidence that diverse discussions had larger benefits for either gender. Finally, there was no significant correlation between how early students signed up for a discussion and their benefits.

Other measures of geographic diversity

The results of our analysis were consistent when we used other measures such as the pairwise distance between participants' locations. We use the number of countries while describing results because it is more interpretable.

Limitations

This experiment included two classes, Social Psychology and Organizational Analysis. Both classes used Talkabout in discussions focused on critical thinking and sense-making. As such, evidence that geographically diverse discussions improve engagement and learning may not generalize to classes that emphasize procedural knowledge (e.g. Corporate Finance), or classes where benefits from global perspectives are smaller (e.g. physics). That said, even the most procedural topics require critical thinking and judgment, and as many instructors have found, topics like physics that seemingly don't benefit from global perspectives may still benefit from discussions [10, 38].

Geographic diversity encodes many other kinds of diversity, e.g., economic opportunities, cultural values, and education experience. Each of these dimensions may have differing benefits for online classes. Future work could build theory that differences matter when.

DISCUSSION

It can be difficult to demonstrate measurable learning effects using design interventions in online courses. For example, while it is possible to increase student involvement in forums [1], improving grades and retention has remained challenging [8, 55]. However, Talkabout increases both learning and engagement (Table 3). One reason for this improvement may be that Talkabout developed a pedagogical approach alongside the software. In pilots without meaningfully structured discussions, it fared poorly. Furthermore, Talkabout builds a social environment and an

Study 1: Discussion participation with a wait-list control Participating in a video discussion with peers increases participation in quizzes and marginally improves performance.
Study 2: Controlled manipulation of geographic diversity Students in high geographic diversity discussion groups perform higher.
Study 3: Large-scale study of geographic diversity High geographic diversity discussions lead to improved short-term performance in two classes, but do not improve multi-week retention.

Table 3: Summary of experimental results

opportunity for reflection. It does this via a medium that is known to build trust [49] and is suited for open-ended discussions [52], such as those leading to sense-making [13].

Geographic diversity's direct effect is in students meeting people from other world regions. It is associated with changes in several other diversity measures (e.g., cultural values, economic opportunity, and educational experience). This paper demonstrates that geographic diversity indeed impacts these other measures. However, there may be other causal pathways involved. It is possible that students who differ in geographical location still have similar socio-economic backgrounds, and students who live very close may be very different. Future work can develop more nuanced diverse experiences.

Talkabout also points to the benefits of using video for geographically diverse discussions. Video conferencing creates a middle ground of immersion in another culture. With complete immersion in an in-person setting, the norms and views of the majority are pervasive [26, 41]. Students with a minority viewpoint in a fully-immersive experience may find themselves confronted with the choice to either embrace the majority culture (suppressing their own), or reject it and flounder [43]. On the other hand, with the minimal immersion, say, of lectures, students may ignore alternate viewpoints as a mere academic exercise. Video-conferencing may occupy an attractive middle ground: it is interactive, compelling students to engage with their diverse classmates and reflect upon their contact [33]. One student told us in an interview, "Talkabout helps bring the class together -- it makes the learning tangible and real…you are interacting with other people, who are experiencing a lot of different things."

Video-based discussions are not without their problems today. Some countries (*e.g.,* Iran) restrict access to Google Hangouts, low-bandwidth connections degrade the student experience, and installing video-conferencing software remains challenging for some students. However, these technological limitations are likely to lessen as bandwidth becomes more plentiful and software comes pre-installed.

Comparing in-person and online discussions

Recall that Social Psychology allowed students to choose to run their discussion in person instead of online. Students participating in the in-person discussions often turned to close friends and relatives. The shared context made the conversation friendlier. For instance, one participant remarked, "I really like the discussion because it was with my friends… It was really easy to start the discussion." In-person discussions also had lower geographic diversity. One student summarized, "Being from the same age group, social level and from the same community; we had very much similar views about the topics in hand." Students reported difficulties scheduling discussions and keeping them on-topic. One remarked, "We had to reschedule a couple of times [before we could meet]." And with friends, "Turning a conversation towards a scientific discipline such as social psychology was hard and a bit artificial…" Another remarked, "Members were my family... and speaking about some things is not easy!"

The design space of online peer conversations

Talkabout currently implements a particular design for online discussions. To arrive at this design, we explored a number of different decisions in this design space (Table 4).

Always-available discussions lack critical mass

Always-available and unscheduled discussions in classes may enable students to talk with a remote partner whenever they have a question or thought. To test the feasibility of this idea, we created a version of Talkabout where students could sign up for an immediate discussion. If another student indicated their availability within the next hour, Talkabout would email both to set up a discussion.

We tested this version in the Think Again philosophy and argumentation class over a three-day period. Of the 2,940 who saw the opportunity, 54 students signed up. Unfortunately, only 5 students overlapped within the one-hour window. This suggests that MOOCs attract many students, but their presence on the course site does not spontaneously overlap. Therefore, Talkabout instead adopts a *bus stop model* where discussions occur at regular time intervals, making critical mass more likely.

Students prefer to negotiate roles informally

Prior work suggests including a designated discussion facilitator to attend to group dynamics in distributed discussions [35]. Could formal facilitators improve Talkabout discussions? We conducted a between-subjects experiment with two conditions (n= 80) in the Organizational Analysis class. In the *facilitator* condition, all participants in a Hangout saw a button to volunteer to be a discussion facilitator. When a student volunteered, the system would show them facilitation tips. Other participants saw a message that the volunteer was facilitating the discussion. In the *control* condition, students were not shown the button to volunteer. Of the 40 students in the *facilitator* condition, seven volunteered. An intention-to-treat analysis showed a trend toward students in the *facilitation* condition feeling the discussion

was less motivating (Mann-Whitney U = 191.5, *p=0.09*), and a trend toward less willingness to meet the same group again (U=191.5, *p=0.09*). These results suggest that fluid negotiation of moderation may work better than a formal facilitation role.

Rigidly enforced scripts lower satisfaction

Prior work in CSCL suggests that structuring collaboration between students using instructions or scripts yields improved learning [42]. What is the right degree of scripting? In a between-subjects experiment (n=82) in the Organizational Analysis class, we explored the benefit of an enforced script. In this condition, Talkabout only showed the current discussion topic, and participants needed to click a button to indicate completion and advance to the next topic. The *control* condition agenda showed all topics at once.

Design Dimension	Choices		
Same discussants every time?	Yes	No	When possible
Group size	Small		Large
Discussion guidance	None	Guidelines and prompts	Scripts
Role negotiation	Instructor specifies	Technologically mediated	Informal
Discussion scheduling	On-demand any time	Bus stop: regular intervals	Same time every week

Table 4: Talkabout's current implementation highlighted in dark blue, design choices that we found to be worse are highlighted in (light) red.

Of the 50 students in the *enforced-script* condition, only 4 clicked the "next topic" button even once. In the post-survey, students also reported they felt the discussion was less motivating (Mann-Whitney U= 193, p=0.07), and that they were less willing to meet the same group again (U = 191.5, p= 0.08). This suggests that enforcing a discussion order may undermine the social benefits of Talkabout [14].

Same-partner discussions have inadequate participation

In the in-person classroom, it is common practice to assign students to groups with fixed membership for the duration of a project or series of discussions throughout a course [6]. Repeated interactions in such groups build trust and rapport [3]. By contrast, non-persistent groups lack familiarity but expose students to different viewpoints.

In a between-subjects experiment in the Think Again class (n=522), we randomly assigned students to either a *persistent* or *control* condition. The persistent condition assigned students to the same group for every discussion. The control condition assigned them to a group when they arrived to the site, as described previously. Students in both conditions attended the same number of discussions (μ=0.46, t(522)=0.33, *p=0.73*). However, as students dropped the class, the size of discussion groups in the persistent condition kept shrinking until they were no longer viable. While 27% of the control groups had at least 5 discussants, only 2% of the persistent groups did (t(81)=4.67, *p<0.001*). Therefore, our discussion strategies structure discussions to leverage changing partners. The next step might be to forge a middle ground where Talkabout prefers familiar partners but adapts groups if previous partners drop out.

CONCLUSION

This paper suggests that the geographic diversity in online classes can be an educational asset. Instead of becoming a handicap, distance can expose students to others and to other ways of thinking. However, leveraging the diversity of online environments requires careful design. This paper describes one such approach, Talkabout, which uses video chat to create discussions between students across the world. Embracing and designing for diversity can enable other innovations. For instance, instructors could leverage students as co-creators and draw on students' local observations to showcase how course concepts arise differently around the world. Likewise, international relations or security courses might launch a global crisis simulation with each student representing their own region. These educational experiences offer a glimpse of the potential of thinking "beyond being there" [25]. They are not just leveraging geographic diversity—they would be impossible without it.

ACKNOWLEDGMENTS

We are grateful to Dan Schwartz for thought-provoking discussions and feedback with early drafts; Coursera and the OpenEdX teams for platform integration and encouraging instructors to try Talkabout; instructors of the many MOOCs who use Talkabout in their classes, and the many students who connected with their peers and shared their stories with us. This research was funded in part through NSF grants #1351131 and #1444865, the Hasso Plattner Design Thinking Program, and the Siebel Scholars Program. This research was conducted under Stanford IRB protocol #30319.

REFERENCES

1. Anderson, A. et al. Engaging with massive online courses. (2014), 687–698.
2. Aronson, E. and Bridgeman, D. Jigsaw groups and the desegregated classroom: In pursuit of common goals. In *Readings About The Social Animal*. Worth Publishers, 2004, 532.
3. Bos, N. et al. Effects of four computer-mediated communications channels on trust development. *Proc CHI: ACM conference on Human factors in computing systems*, ACM Press (2002).
4. Braskamp, L.A. et al. Assessing Progress in Global Learning and Development of Students with Education Abroad Experiences. *Frontiers: The Interdisciplinary Journal of Study Abroad 18*, (2008), 101–118.

5. Breslow, L.B. et al. Studying learning in the worldwide classroom: Research into edX's first MOOC. *Research & Practice in Assessment 8*, (2013), 13–25.
6. Brookfield, S.D. and Preskill, S. *Discussion as a Way of Teaching: Tools and Techniques for Democratic Classrooms*. John Wiley & Sons, 2012.
7. Clementi, F. and Mauro Gallegati. Econophysics of Wealth Distributions. In Chatterjee, A. et al., eds., *Econophysics of Wealth Distributions*. Springer Milan, Milano, 2005.
8. Coetzee, D. et al. Chatrooms in MOOCs: all talk and no action. *Proc. of the ACM conference on Learning @ scale*, ACM Press (2014), 127–136.
9. Coser, R.L. The Complexity of Roles as a Seedbed of Individual Autonomy. In *The Idea of Social Structure: Essays in Honor of Robert Merton*. New York, New York, USA, 1975.
10. Crouch, C.H. and Mazur, E. Peer Instruction: Ten years of experience and results. *American Journal of Physics 69*, 9 (2001), 970.
11. Daft, R.L. and Lengel, R.H. Organizational Information Requirements, Media Richness and Structural Design. *Management Science 32*, 5 (1986), 554–571.
12. Desai, M. Human development: Concepts and measurement. *European Economic Review 35*, 2-3 (1991), 350–357.
13. DeSanctis, G. et al. Learning in Online Forums. *European Management Journal 21*, 5 (2003), 565–577.
14. Dillenbourg, P. Over-scripting CSCL: The risks of blending collaborative learning with instructional design. *Three worlds of CSCL. Can we support CSCL?*, (2002), 61–91.
15. Freedman, J. MOOCs Are Usefully Middlebrow. *The Chronicle of Higher Education*. http://chronicle.com/article/MOOCs-Are-Usefully-Middlebrow/143183/.
16. Goesling, B. Changing Income Inequalities within and between Nations: New Evidence. *American Sociological Review 66*, 5 (2001), 745–761.
17. Green, E.G.T. Variation of Individualism and Collectivism within and between 20 Countries: A Typological Analysis. *Journal of Cross-Cultural Psychology 36*, 3 (2005), 321–339.
18. Group, W.B. *World Development Indicators 2012*. World Bank Publications, 2012.
19. Gurin, P. et al. Diversity and higher education: Theory and impact on educational outcomes. .
20. Guzzetti, B.J. and Others, A. Promoting Conceptual Change in Science: A Comparative Meta-Analysis of Instructional Interventions from Reading Education and Science Education. *Reading Research Quarterly 28*, 2 (1992), 116–59.
21. Hambrick, D.C. et al. When Groups Consist of Multiple Nationalities: Towards a New Understanding of the Implications. *Organization Studies 19*, 2 (1998), 181–205.
22. Heine, S.J. *Cultural Psychology*. WW Norton, 2008.
23. Hewstone, M. Intergroup contact: Panacea for prejudice? *Psychologist*, 2003, 352–355. http://www.psy.ox.ac.uk/publications/28661.
24. Ho, A.D. et al. HarvardX and MITx: The First Year of Open Online Courses, Fall 2012-Summer 2013. *SSRN Electronic Journal*, (2014).
25. Hollan, J. and Stornetta, S. Beyond being there. *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '92*, ACM Press (1992), 119–125.
26. Hurtado, S. et al. The Climate for Diversity: Key Issues for Institutional Self-Study. *New Directions for Institutional Research 1998*, 98 (1998), 53–63.
27. Hurtado, S. et al. Enacting Diverse Learning Environments: Improving the Climate for Racial/Ethnic Diversity in Higher Education. ASHE-ERIC Higher Education Report, Vol. 26, No. 8. (1998).
28. Jacobs, A.J. Grading the MOOC University. *The New York Times*, 2013.
29. Joinson, A.N. Knowing Me, Knowing You: Reciprocal Self-Disclosure in Internet-Based Surveys. *CyberPsychology & Behavior 4*, 5 (2001).
30. Konstan, J.A. et al. Teaching recommender systems at large scale. *Proc of the ACM conference on Learning @ scale conference*, ACM Press (2014).
31. Kucsera, J. and Orfield, G. *New York State's Extreme School Segregation: Inequality, Inaction and a Damaged Future*. 2014.
32. Kulkarni, C. et al. Peer and self assessment in massive online classes. *ACM Transactions on Computer-Human Interaction (TOCHI) 20*, 6 (2013), 33.
33. Lin, X. and Schwartz, D.L. Reflection at the Crossroads of Cultures. *Mind, Culture, and Activity 10*, 1 (2003).
34. Losh, E. *The War on Learning: Gaining Ground in the Digital University*. MIT Press, 2014.
35. Mark, G. et al. Meeting at the Desktop: An Empirical Study of Virtually Collocated Teams. *ECSCW*, Kluwer Academic Publishers (1999).
36. Markus, H. and Kitayama, S. Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review 98*, 2 (1991), 224–253.
37. Marmot, M. Social determinants of health inequalities. *Lancet 365*, 9464 (2005), 1099–104.
38. Mazur, E. Farewell, lecture? *Science (New York, N.Y.) 323*, 5910 (2009), 50–1.

39. Nemeth, C.J. Differential contributions of majority and minority influence. *Psychological Review 93*, 1986.
40. Nguyen, M. et al. Comparing online and offline self-disclosure: a systematic review. *Cyberpsychology, behavior and social networking 15*, 2 (2012).
41. Nora, A. and Cabrera, A.F. The Role of Perceptions in Prejudice and Discrimination and the Adjustment of Minority Students to College. *Journal of Higher Education 67*, 2 (1995), 119–48.
42. O'Donnell, A.M. and Dansereau, D.F. Scripted cooperation in student dyads: A method for analyzing and enhancing academic learning and performance. In *Interaction in cooperative groups: The theoretical anatomy of group learning*. Cambridge University Press, Cambridge, UK, 1995, 120–141.
43. Ogbu, J.U. Understanding Cultural Diversity and Learning. *Educational Researcher 21*, 8 (1992), 5–14.
44. Olds, K. Mapping Coursera's Global Footprint. *Inside Higher Ed*, 2013. http://www.insidehighered.com/blogs/globalhighered/mapping-courseras-global-footprint.
45. Papadopoulos, K. et al. Community TAs scale high-touch learning, provide student-staff brokering, and build esprit de corps. *Proceedings of the first ACM conference on Learning @ scale conference - L@S '14*, ACM Press (2014), 163–164.
46. Parker, W.C. Classroom Discussion: Models for Leading Seminars and Deliberations. *Social Education 65*, 2 (2000), 111–15.
47. Pettigrew, T.F. Intergroup contact theory. *Annual review of psychology 49*, (1998), 65–85.
48. Purdie, N. and Hattie, J. Cultural Differences in the Use of Strategies for Self-Regulated Learning. *American Educational Research Journal 33*, 4 (1996), 845–871.
49. Rocco, E. Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact. *Proc of CHI: ACM Conf on Human Factors in Computing Systems*, ACM Press (1998).
50. Saltarelli, A.J. Effects of belongingness and synchronicity on face-to-face and computer-mediated online cooperative pedagogy. (2012).
51. Shenkar, S. and Oded, R. Clustering Countries on Attitudinal Dimensions: A Review and Synthesis. *The Academy of Management Review 10*, 3 (1985), 435–454.
52. Short, J.E. et al. *The Social Psychology of Telecommunications*. Wiley, London, 1976.
53. Star, S.L. and Griesemer, J.R. Institutional Ecology, `Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science 19*, 3 (1989), 387–420.
54. Symons, C.S. and Johnson, B.T. The self-reference effect in memory: A meta-analysis. *Psychological Bulletin 121*, 3 (1997), 371–394.
55. Tomkin, J.H. and Charlevoix, D. Do professors matter? *Proc. of the ACM conference on Learning @ scale*, ACM Press (2014), 71–78.
56. Tudge, J. *The everyday lives of young children*. Cambridge University Press, Cambridge, UK, 2008.
57. Varnum, Michael EW Grossmann, I. et al. The origin of cultural differences in cognition the social orientation hypothesis. *Current directions in psychological science 19*, 1 (2010).
58. Woolley, A.W. et al. Evidence for a collective intelligence factor in the performance of human groups. *Science (New York, N.Y.) 330*, 6004 (2010), 686–8.
59. *World Values Survey (Wave 6)*. World Values Survey Association, 2014.