

THE ICEBERG METAPHOR OF EDUCATIONAL TELECOMMUNICATIONS: HISTORY AND APPLICATION

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The Interactive Communications & Simulations (ICS) group at the University of Michigan has operated computer-mediated simulations since 1984. One outcome of our experience was the development of a conceptual model for educational telecommunications called the Iceberg Metaphor. This model has been field-tested by thousands of students for over a decade, and the central themes of this metaphor have remained constant while retaining the flexibility to facilitate a wide range of educational simulations. This model should prove useful to educators who are exploring ways to use instructional technologies for K-12, distance, and higher education applications. This paper describes the development of the Iceberg Metaphor and examines how it influences telecommunications projects on both the server side and in the classroom.

Key words

computer-mediated communication, educational telecommunications, international education, Iceberg metaphor, Interactive Communications & Simulations (ICS) group

Introduction

The Interactive Communications & Simulations (ICS) group at the University of Michigan launched its first computer-mediated simulation in the Spring of 1984. Since then, ICS has sponsored a number of other educational simulations which attract participants from 27 U.S. states and 23 countries. Despite rapidly changing technology, and the challenges posed by its different simulations, ICS's basic approach has remained unchanged. This approach, our

conceptualization of educational telecommunications, is based on what we have come to call the "Iceberg Metaphor." This paper will define and explore the meaning of this metaphor, how it shapes the delivery and support of educational telecommunications, and discuss in greater depth its component parts: Interface, mentoring, and classroom.

History

ICS's first simulation, the Arab-Israeli Conflict (AIC), was adapted from a face-to-face educational simulation that had been conducted for nearly a decade as part of an undergraduate political science course at the University of Michigan, and was moved on-line with the aid of

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the CONFER II computer conferencing system also developed at the University (Goodman, 1992; Katterman, 1990). Since then, ICS has developed and operated a number of computer-mediated communication simulations including the "United States Constitution Simulation" (Taylor, 1988), the "Space Forum," "Earth Odysseys," English and French versions of the "International Poetry Guild," and the "World Forum" (Sugar and Banks, 1995), among others.

The Iceberg Metaphor Defined

ICS conceptualizes the learning experience facilitated by educational telecommunications using an iceberg metaphor. That is, the on-line communication between participants in a simulation is seen as similar to the 10% of the iceberg that remains above the water's surface. The remaining 90% of the learning experience takes place through the face-to-face interactions of students and teachers nested in classrooms around the world; interactions that are supplemented, rather than supplanted, by the on-line communications. In practice, this metaphor shapes ICS exercises in several ways: 1) it increases our emphasis on student-generated artifacts, 2) it produces for less directed, more open-ended student participation, 3) focuses our emphasis on student-to-student communications, and 4) changes the type of scaffolding by ICS

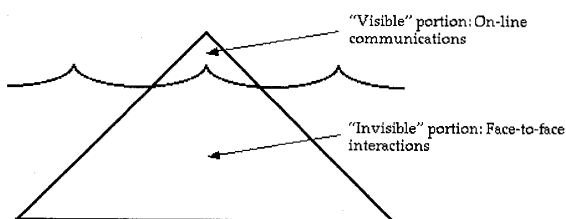


Fig. 1: The Iceberg Metaphor

mentors by both students and teachers.

Of course, these percentages serve as a heuristic to help us understand the nature of these interactions, and to emphasize the importance of the face-to-face component of these exercises which are key to our understanding of the nature of computer-mediated simulations in general.

The remainder of this paper will address how this metaphor shapes the way ICS exercises are delivered (i.e. interface issues), how it changes the role of on-line support (i.e. exercise mentors), and what role classroom teachers are afforded in this educational telecommunication model.

Technological Considerations of the Iceberg Metaphor

The Iceberg Metaphor is about communication, and the tip of that metaphorical iceberg is computer-mediated communications. One might assume that, given the emphasis this heuristic places on face-to-face (FTF) communications, ICS is not particularly interested in, or even discounts, the importance of the on-line communications in our simulations. This is not the case, and this section will offer some insight into how this metaphor has shaped the evolution of ICS's on-line environments.

Tipping the Iceberg

ICS's guiding metaphor assumes that a rich and complex set of interactions are taking place in classrooms that remain largely invisible simply by reading the on-line communications. Based on this assumption, we have attempted to create on-line environments that bring more of these interactions "to the surface." In one sense,

this means providing places in the on-line environment that allow students to show some of the fruits of their face-to-face interactions. One example is putting the International Poetry Guild's participants' poetry journals on-line for all to read. Another way we work to accomplish this is to develop ways for the user to access outside resources, or for them to bring outside resources into the exercise. This capability has only become possible with the recent migration of ICS's exercises to the World Wide Web. The path we took, from CONFER II to the Web, deserves some additional explanation.

Technological Evolution

As mentioned above, ICS's early exercises were created on the University of Michigan's CONFER II mainframe conferencing system that offered a command-line interface. While the interface was limited, CONFER II offered item/response threading, a rare feature even in today's CMC environments. After 10 years of service, and drastic changes both in classroom access as well as the University's computing environment, the end of the mainframe was near, and we began exploring alternative environments to support our exercises.

The first step was Visual Confer (VisCon) which had a limited ability to digest new articles. This limiting "feature" was an advantage as it could be configured to support the goals of a particular exercises. Connectivity, however, was another issue. In CONFER II, distant schools could connect by reversing the SprintNet charges (effectively making collect calls to the University mainframe). VisCon relied on schools having "Telnet" access, which proved both rare and unreliable. In addition,

the digest feature didn't work well in practice, and it was based on a "one computer- one classroom model" which wasn't in sync with the various end users' situations.

A new alternative was necessary, and we experimented with an e-mail based digest system. E-mail conferencing offered the broadest connectivity, accommodating all types of end user situations (i.e. one computer-one classroom, many computers- one classroom, and/or many users-one computer), and it provided extended support for digests and extensibility which allowed it to meet the needs of our various simulations. However, among its limitations were the lack of an intuitive way to track discussion threads, and the difficulty of supporting the wide variety of e-mail formats used in classrooms in various countries.

WWW: The Next Generation

We are currently experimenting with a World Wide Web/e-mail system. While this technology is relatively new, and changes rapidly, it builds upon most of the advantages of previous models, while avoiding some of their limitations (although like any new technology, it presents its own challenges). This model provides all of the advantages of the former e-mail system with several important advantages:

- Outline method of seeing complete threads
- Digests via the WWW (able to see the new posts since your last visit to the site)
- For e-mail users, richer posts (HTML, graphics, etc.)
- For WWW users, richer posts, links to outside resources, etc.

Missing from the above list is relatively common technologies, such as the USENET. This is



Messages [Inline Depth: 1 2 3 All] [Outline Depth: 1 2 3 9 All]

2. Ed Resources on the Web/International Channel (Douglass Scott) - 9/09/96
4. Conference Security (Douglass Scott) - 9/13/96
5. Global Ed Workshops for Teachers on World Cities (Douglass Scott) - 9/17/96
6. FYI: Virtual Discussion Navigation Tips (Douglass Scott) - 9/22/96
7. Important info re Basic Skills Test Deadline (Douglass Scott) - 9/23/96
8. A place for those excellent personal essays (John Doe) - 10/01/96
 1. Another place for those excellent personal essays (Douglass Scott) - 10/04/96
9. Reading for Tues. 10/8 (Bill Behre) - 10/04/96
10. Jo Ann Doe's Web page is up! (Douglass Scott) - 11/01/96 **NEW**
 1. re: Jo Ann Doe's Web page is up! (Jo Ann Doe) - 11/01/96 **NEW**
12. 9/9 Presentation: Esp. math & sci folks (Douglass Scott) - 11/01/96 **NEW**
13. Ed software on the Web (Douglass Scott) - 11/02/96 **NEW**
14. Feeling Down? Tired? (John Doe) - 11/06/96 **NEW**
15. 11/14 Seminar at Glenn (Douglass Scott) - 11/13/96 **NEW**

Fig. 2: Screenshot of a discussion group representing an early version of ICS's WWW-based interfacer

not an oversight on our part since students don't, by design, "live" in the system, it needs to first support the visible portion of the iceberg. Offering ICS exercises on USENET (or pure e-mail, say) would not be acknowledging the iceberg effect, because both technologies are very temporary. Whatever system you use needs to let people get the materials now for their class, and be available later when reflection has to tie back to earlier discussion. Thus, the system has to be its own artifact.

Technology Section Summary

We are often asked why we don't explore two-way video or real-time chat interfaces. Certainly these technologies offer intriguing possibilities, especially in light of our goal to make more of the in-class interactions visible to the other participants. However, despite their surface appeal, the global nature of ICS exercises, in part, prevents us from incorporating these

technologies. ICS activities don't center around any one particular class or time period (or even time zone!), so they're happening at different times in different ways. We feel, however, that this apparent limitation is in fact an advantage since the asynchronous nature of our simulations allows more time for important processing, reflection, and discussion time in the classroom before a message is composed and sent to the other groups.

This section described the technological environment in which ICS exercises take place. The next section addresses the role of one group of people who interact within this environment: The "mentors" in ICS's International Poetry Guild.

On-line Mentoring in the Iceberg Model

An example of the iceberg model in practice is the International Poetry Guild (IPG) which was

first offered in the Spring of 1990. Students electronically submit poems to the IPG conference where other students and ICS mentors can discuss them, offer encouragement, and make constructive comments. As poems are submitted, other participants evaluate them for possible inclusion in their own poetry journal, a thematic collection of poems created by each class and the culminating project of each group of IPG participants. Finished journals range from the hand-made to the professional printed, but all require a great deal of time and energy to plan and execute. All of these on-line components are supported and scaffolded by a “mentors,” University of Michigan undergraduates who are interested in poetry, and in guiding young poets using this telecommunication format.

The Poetry Guild exemplifies ICS’s emphasis on facilitating face-to-face interaction through telecommunications. Prior to submitting a poem, students would be instructed by their teacher on the genre, and would practice writing different types of poetry in class. Creating a poetry journal involves editorial decisions (e.g. What is our theme? Which poems should we reserve?), page layout (i.e. should we use a different font for each poem?), artwork, photography, and, in some cases, marketing as the journals are sold to generate funds to pay for the next IPG session. Thus, while IPG is facilitated by the electronic transfer of poetry and on-line discussion, the bulk of the participants’ learning experience takes place through face-to-face interactions in the classroom--the 90% of the iceberg that is invisible simply by reading a transcript of the on-line communications.

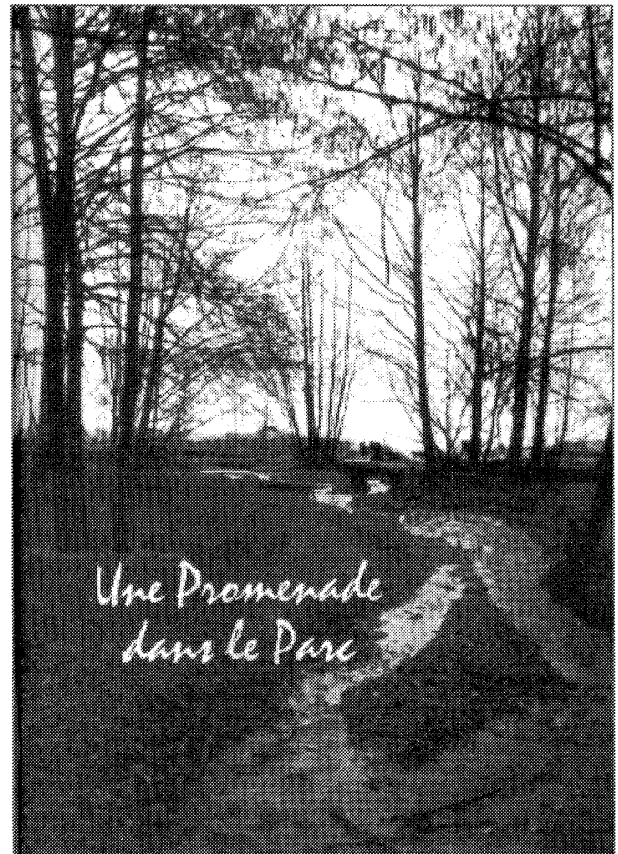


Fig. 3 : An example of a student-produced IPG journal

Mentor Challenges in the IPG

There are a number of issues that repeatedly come up (in some fashion or another) for the International Poetry Guild mentors. At their core, many of these issues center around how best to nurture creativity in others. We will start from the assumption that, even if it is done under duress, it is a brave thing for a teenager (for anyone, in fact) to share her/his work with a worldwide audience of peers, teachers, and mentors. It may also be perceived as exciting, gratifying, too abstract to get one’s brain around, or even (God forbid!) “so what?” For argument’s sake, though, let’s assume that the majority of the students have some personal investment in the creation and sharing of their work, even

those that would tell you they hate poetry. We should also assume that the work of these poets is frequently (and understandably) characterized by a lack of sophistication, by a heavy reliance on rhyme, and by a tendency to focus on “big” topics like love (in writing about which it is all too easy to fall into cliché).

Now, all of this presents the mentors with a complex set of questions and challenges. To start with, we believe is crucial that the mentors avoid condescension in tone and/or content when responding to the poets. We don’t believe it serves the poet or the mentors to simply dispense praise on their poem, whatever they might feel about the work. Their challenge is to work towards being both supportive of and candid with the poets, through a repeated series of interactions with them. Further, this challenge must be met without necessarily being able to rely on the terminology or shared understandings the mentors would likely have with their peers and instructors. They must necessarily backtrack and explain terms that they’re not currently accustomed to explaining. The mentors can move between commenting on specific poems and making general comments to the entire group of poets, as they try and find the optimal way to raise issues forthrightly, while not bringing a particular work uncomfortably on stage as the “target” of their comments. They must also strive to do this in a way that protects the safety of the “environment” for the poets, and makes them want to continue posting their work. This connects with the practical matter of the nature of the interaction itself. There are only words, and the absence of facial expressions, gestures and intonations focuses tremendous attention on those words. All of this necessitates a continually thoughtful, sensitive

approach to the interaction with poets.

Mentors’ Role in IPG

There are a couple of other issues which we think are somewhat unique to this type of interaction and merit further investigation. One issue centers around the mentors’ relationships with the poets, as opposed to that of the poets and their teachers. One teacher on our network remarked recently that she’s often had the experience of teaching her students something about poetry and having it, at least outwardly, fall on “deaf ears.” The next day, as she tells it, a communication comes from a mentor that makes the same point and, voila, it clicks! What is described here is surely more complex than what this teacher related to us. She is an exceptional teacher with an amazing rapport with her students and we’re sure she is underplaying her impact on her students.

Whatever the case, though, it raises an interesting issue. The mentors, in this context, have several advantages, if you will. For one, they (in contrast to the teacher or even a college-age student teacher) have no grading responsibility with regard to the poets. They are typically far closer in age to the poets than are the teachers, and are more aware of their interests and hobbies. They know for instance, to paraphrase this teacher again, that the “Red Hot Chili Peppers” are found in a music store and not a supermarket. Finally, the mentors have a clear authority in the exercise; they are the primary source of response to poems and, whether we wish it or not, judgments about them. They are also here at “the source,” the University of Michigan, and this fact alone lends an authority to their words, whether this is deserved or not. Of course, a

reconfiguration of these same factors can contribute to a mentor establishing little or no rapport with the student poets who might, for example, feel that the mentor writes over their heads, or is condescending, or perhaps is simply too far removed from the poets lives to matter much.

The other issues relate to the structure and nature of the exercise itself. We have students who are in daily, ongoing contact with peers in other parts of the world, not only sharing and discussing poetry but also hoping to have their work published by journals based at other schools. If it is true that for a substantial number of students that this type of project is engaging, and helps to cultivate an interest in writing, then one place to explore would be this broadened classroom. How is the school dynamic changed by preparing work that isn't handed in to the teacher, but is submitted to this larger audience? Is there substantial motivating force in what might be called the "real world" applications involved in this kind of endeavor (putting together and publishing journals, the possibility of having one's work published somewhere else, etc.)?

Mentor Section Summary

We are still considering how best to approach these questions, but centering on the mentor-student relationship points us in several possible directions which address both sides of our iceberg model.

1) Examination of transcripts from the conference to examine the "on-line" interactions that take place. What kinds of things, for example, do students say to mentors? How often are students willing to tell a mentor that s/he misun-

derstood their work, for example, or to "talk back" to them based on their comments on one of their poems? How often are students sufficiently moved by comments made by a mentor that they express thanks to a mentor for commenting on their work or for an idea, or perhaps express pleasure at what they see as an insightful "read" of their work? How do they handle being critical of a poem, and how do they respond when a student disagrees with or questions the mentor's interpretation of their work?

2) Interviews with students, teachers & mentors and classroom observations. Even though there is a substantial written record produced from each of these conferences, we firmly believe--and the Iceberg Metaphor suggests--that much the most important "stuff" isn't found in the conference transcript alone. We're inclined to ask students questions like: Do you have any intention of writing poetry after this project ends? Describe your feelings about the act of sharing poetry publicly--have they changed over the course of this project? What have you found to be the most engaging part of this project?--getting your work published, having it commented upon by the mentors, establishing a connection with peers in other places, expanding your knowledge of and/or interest in poetry? How do you regard the mentors, and how do you see them differently than you see your teacher?

ICS mentors have been an indispensable part of our exercises from the beginning. We believe the mentors' contribution is crucial to the effective operation of our exercises. Our mentors exhibit numerous skills, content-based and interpersonal, and the role of mentoring on-line conferences is a major area of future research.

Teachers' Role in the Iceberg Model

The Iceberg Metaphor was explained above, and the International Poetry Guild (IPG) was offered as an example of this metaphor in practice. IPG is exemplary of how the learning of groups of students nested in classrooms is facilitated by computer links with their peers. IPG, like all ICS exercises, progresses through student-generated artifacts (e.g. poems, messages, discussion) rather than through materials supplied by ICS. This places an additional burden on classroom teachers who are essential in guiding their students through preliminary writing exercises, helping them organize their own Guild, and supervising the creation of their poetry journal.

The notion that much (as mentioned above, the metaphor's 10/90 split is a heuristic emphasizing the importance of in-class interactions) of the students' learning takes place within their classroom empowers teachers by acknowledging the importance of their efforts in this process. Unlike a distance learning situation where student and teacher are separated, teachers participating in ICS exercises work directly with their students and the products of these interactions are transmitted to other groups working in a similar fashion. Our simulations are predicated on this relationship as they foster student-student and student-teacher interactions rather than asking them to rely on the exercise for project content.

ICS mentors and program coordinators have visited a number of classrooms over the years to see how our exercises are actually used in schools. This type of "behind the scenes" look at our exercises helped strengthen our under-

standing of, and belief in, the Iceberg Metaphor. This section presents data from two such visits, describing how these teachers used ICS exercises in their classrooms, and how their engagement with the exercises provides a model for other educators interested in using CMC resources.

Climbing the Learning Curve

The push to bring schools on-line places a great burden on teachers, most of whom have little or no experience with computers or telecommunications and many struggle to include these technologies in their classes. One veteran middle school teacher describes the difficulties she encounters in trying to incorporate these technologies into her teaching:

[using computers and telecommunications] doesn't come naturally. I'm an old dog learning new tricks. But I love working with kids and I like to teach creatively and to teach relevantly and I see telecommunications as a way of communicating for the future, not just for schools, but all over the place and I feel if there's any way that I can get the kids participating in this and aware of it, that I'm doing them a service. But I have to struggle with it... "Mrs. Patterson,"
7th grade science teacher

Many teachers with whom we work are in a similar position. They are intrigued by the potential of the Internet to bring outside resources into their classroom, but are apprehensive about how they will integrate these resources into their curriculum, and what is their role in this process.

The following descriptions came from discussions with two junior high school science teach-

ers, and both were participating in the "World Forum," a role-playing exercise that followed the progress of a group of explorers who were preparing to cross the arctic on foot (Sugar and Banks, 1995). While there was a minute amount of science-related content (e.g. daily temperature, barometric pressure, and wind gauge readings), the exercise mainly focused on social issues (e.g. the displacement of native people's by encroaching oil exploration) laced with native American poetry and songs. At the outset, it was difficult to see how this exercise could be incorporated into a general junior high school science class.

The first teacher, "Mr. Brandt," had been part of the committee that crafted Michigan's state-wide science test. He explained that the test questions were divided into two general types: Those that tested content knowledge, and those that emphasized knowledge construction and reflection skills. His rationale for participating in the World Forum was simple: In his view, the World Forum fostered knowledge construction and reflection skills that, while not related specifically to science, were useful practice for his students. His students would spend a short amount of time, approximately 10 minutes, three times each week working on the Forum. His plan was to have the students download, distribute, and read the previous week's discussion on one day, craft a group response to one of the discussion threads on a second day, and post their message on a third day. In practice, this plan was rarely met. The group was plagued with technical problems (e.g. unable to access the conference), the volume of information downloaded exceeded what could be comfortably covered in 10 minutes, and, as Mr. Brandt put it, "Seventh graders don't type," which further con-

tributed to their minimal on-line presence.

The second teacher, "Mrs. Patterson" whose quote appears at the beginning of this section, was less interested in the construction and reflection aspects of the exercise than her colleague. Unlike Mr. Brandt, she was personally uncomfortable with the computer which was a barrier to her full participation in the Forum. However, she was determined to overcome her fear in order to provide her students, most of whom were from lower socio-economic status families, with exposure to these new technologies which she saw as essential for their future. Her approach was to divide the class by gender, with the girls role-playing a female character and the boys role-playing a male character. She would devote one class each week to the Forum which yielded slightly more on-line communications than did Mr. Brandt's approach.

Teachers' Section Summary

These classroom observations and interviews serve as one example of the viability of ICS's model. Although each teacher approached the World Forum in different ways, the activity and engagement observed in these classrooms belied their negligible on-line presence. For example, Mrs. Patterson's students put on a short skit as one way of learning more about the characters they were going to role play. They also read and discussed many of the conference's messages, although they rarely responded to them on-line. Mr. Brandt's class would hold a group discussion about messages from the conference and reach a consensus about how to respond. They also used the minimal weather data during a separate unit on weather to compare conditions in the arctic to their local area. Each

teacher gave all their students an opportunity to get involved in the exercise: Students would rotate jobs like downloading the discussion, distributing copies, and typing in messages.

In contrast to the limited number of messages they sent to the Forum, both classes experienced a variety of learning activities that were facilitated by, but extended far beyond, time spent at the computer.

The previous observations and experiences provide but a brief glimpse into the actual engagement of teachers and students with ICS's exercises. However, these examples serve to inform our thinking about computer-mediated communications in instructional settings, and push us to continue to develop exercises that foster our participants' face-to-face interactions.

Conclusion

This paper defined the Iceberg Metaphor for educational telecommunications, and described how this conceptual model shapes ICS's choice of technological environments, on-line mentoring, and classroom use. The preceding discussion presented several implications and considerations for educational technologists who develop similar exercises, and educators who use them in their classrooms. The final section will detail some of the implications for educational technology researchers.

Implications for Research

The Iceberg Metaphor suggests that the bulk of participants' learning takes place through face-to-face interaction rather than through on-line discussion. However, most research into computer-mediated communications focuses on

the messages transmitted between participants. Certainly the ease with which certain numerical data are collected (e.g. number of times participants log into the conference, the number of messages sent, average words per message) combined with the archival of all messages (automatic transcription) facilitates such analysis. However, such data shed little light on the participants' off-line engagement, that is, the context within which they are engaging in the on-line discussion. These data are not automatically generated in the course of the CMC discussion, and alternative data collection methods become necessary.

This shift in focus, from computer-mediated to individual user's engagement, does not eliminate the need for studying on-line discourse. Indeed, this discourse provides a crucial connection between the learners participating in the conference. However, while some studies consider the end-user's engagement with the technology in passing, few studies make such analysis the central theme of their research. To link this back to the iceberg model, the goal of such research is to make more of the iceberg visible by bringing to light the perceptions of and engagement with computer conferencing. We believe that exploring alternative ways of studying this off-line engagement is an appropriate area for future research.

The number and type of educational telecommunications offerings has exploded in the years since ICS began its first exercise in 1984. Students at all grade levels are gaining Internet access to the Internet, and educators are searching for appropriate ways to incorporate these resources into their curricula. We hope the model presented in this paper helps other educators select and use the most appropriate

exercise for their students from among the myriad of available options. We also hope that this model will contribute to the discussions surrounding the creation, operation, and study of educational telecommunication projects.

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教育的テレコミュニケーションの「アイスバーグ・メタファー（冰山隠喩）」：その歴史と応用

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ミシガン大学ICS（相互伝達・模擬実験）グループは1984年以来コンピューター媒介による模擬実験を行って来た。実験の成果の一つとして、アイスバーグ・メタファー（冰山隠喩）と呼ばれる教育的遠距離通信に関する概念的モデルを創り出したことがあげられる。このモデルは10年以上に渡り何千人もの学生によって現場でテストされ、その結果この隠喩の中心的主題は不変であり、その一方で広範囲におよぶ教育的模擬実験を促進する柔軟性を備えていることが分かった。このモデルは、K-12、遠距離教育、高等教育などへ応用するための教育技術導入の道を模索している教育者には有益となるはずである。当論文はアイスバーグ・メタファーの発展を述べると共に、それがサーバー側と教室内の双方に関するテレコミュニケーション（遠距離通信）研究にどのような影響を与え得るかについて考察するものである。

キーワード

コンピューター媒介による伝達、教育的遠距離通信、国際教育、アイスバーグ・メタファー、相互伝達・模擬実験（ICS）グループ

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