Evaluation of a Collaborative Project using ICT in Small-Scale Schools to Achieve a Wide Variety of Relationships

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Abstract

In this study, we designed a system to provide children attending small-scale schools with opportunities to form a wide variety of interpersonal relationships. The system, which employed web conference terminals to provide a continuous connection between three physically remote elementary schools, was installed and operated for a fixed period of time. The study served to clarify issues involved in building and operating this type of system environment. Many of the problems encountered may be thought to stem from our project's attempt to achieve simultaneous operation across three schools. However, the study also clarified a number of advantages this type of system may provide. In particular, children at each school demonstrated a proactive desire to interact with their counterparts at the other schools, and this suggests that interactions made by way of Information and Communication Technology (ICT) may be a valid method of providing relationship-building opportunities to children. Conventional use of ICT in schools has largely been limited to the classroom; however, this study suggests the potential for ICT to be used in a variety of student activities outside of class as well.

Keywords: Web Conference System, Small-Scale Schools, ICT, Rural Education

1. Background

Among the social challenges faced by Japan today, one major issue is the combination of an aging population and low birth rate, compounded further by a continuing trend for the population to concentrate in urban areas. This issue has had a major effect on schools located in prefectures with relatively small-scale, local populations (hereafter, "small-scale prefectures"). In marginal and rural areas far removed from the more urbanized sections of these small-scale prefectures, major decreases in youth populations are already leading to a lack of children in some areas, and it is becoming clear that the continued existence of elementary and lower secondary schools in these areas may be difficult.

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Table 1. Advantages and disadvantages of schools by scale (examples)

	Small-Scale Schools	
	Advantages	Disadvantages
【Academic Concerns】	Easier to pay individual attention to each student, and easier to provide more comprehensive, individualized guidance	Risk of providing fewer opportunities for exposure to varied ways of thinking in group settings, opportunities to learn from peers, and opportunities for peers to challenge each other to grow through friendly competition In cases where a grade contains only enough students to form a single class, the loss of opportunities for students to work together as a class and compete against other classes of peers, as a method to promote overall group development
	Easier to provide each student with specific, individual opportunities to participate in school events, extracurricular activities, etc.	Greater likelihood of experiencing limitations in scope of school events such as sports days and group education activities such as musical ensembles In lower secondary schools, increased difficulty in ensuring placement of licensed faculty members for each academic subject Because of the reduced number of students, as well as of faculty members, increased difficulty in implementing varied types of instruction and learning opportunities, such as group learning sessions, learning opportunities tailored to different levels of student proficiency, or opportunities to receive instruction from specialized faculty in elementary schools
		Increased difficulty in establishing extracurricular groups and reduced variety of extracurricular activities for students to choose from
【Lifestyle Concerns】	Easier for students to develop deeper human relationships with their peers Interaction between different grades and ages can occur more easily	More difficult to reorganize students into different classes, leading to a greater likelihood of stagnant relationships and unchanging interpersonal evaluations among peers Greater likelihood of a significant skew in the male to female ratio of the group Reduced opportunities for peers to challenge each other to grow through friendly competition
	Easier to pay individual attention to each student, and easier to provide more comprehensive, individualized guidance	More difficult to form an organizational structure, and easier to encounter limitations in instruction method
【Administrative and Financial Concerns】	Easier to achieve mutual understanding and tight coordination across all faculty members Easier for the school to act as one cohesive unit	Because of limited faculty size, more difficult to achieve good balance in terms of experience, academic specialties, and characteristics Faculty members themselves less able to engage in discussion, research, or collaboration across different grades and subjects, and reduced opportunities for faculty members to challenge each other to grow through friendly competition Increased likelihood of single faculty members being required to fill a large variety of roles around the school Greater likelihood of experiencing difficulty in coordinating dispatch of faculty members to participate in research opportunities or work duties taking place outside the school
	Easier to coordinate usage times of school facilities and equipment	Greater likelihood of increased expense incurred per child
【Other Concerns】	Easier to collaborate with guardians and local communities	Greater likelihood of increased burden on guardians in terms of PTA(Parent-Teacher Association) duties, etc.

The obstacles facing small-scale schools are vast, and such obstacles have already been a focus of much

debate. Discussion on the topic is occurring even at the highest levels of Japan's national government. In order to consider the issues posed by small-scale schools, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) has formed the "Working Group to Determine Appropriate Establishment and Administration of Elementary and Lower Secondary Schools" (Shō, Chūgakkō no Secchi, Unei no ArikatatōnikansuruSagyōbukai) inside the Subdivision on Elementary and Lower Secondary Education of its Central Council for Education. The eighth meeting of the "Working Group to Determine Appropriate Establishment and Administration of Elementary and Lower Secondary Schools," held in December 2008, included discussion of a document entitled "Advantages and Disadvantages of Schools by Scale (Examples)" (Ministry, 2008). The information in this document was compiled by MEXT, taking into account plans for suitable placement of schools as laid out by cities, towns, and villages in each of Japan's prefectures. It outlines the advantages and disadvantages of both small- and large-scale schools. Table 1 provides an excerpt of the information specific to small-scale schools as outlined in "Advantages and Disadvantages of Schools by Scale (Examples)," showing that while small-scale schools do have some inherent advantages in terms of academic, lifestyle, administrative, and financial concerns, those advantages are clearly outweighed by more serious disadvantages. In particular, a number of issues posed by small-scale schools in regard to academic and lifestyle concerns, areas of particular significance to elementary and lower secondary schools, stem from an inability of such schools to provide children with sufficient opportunities to form interpersonal relationships. In terms of academics, students in small-scale schools struggle to form the types of groups that serve as a cornerstone of elementary and lower secondary school education in Japan. This, in turn, hinders critical learning opportunities, including the ones outlined in Table 1, such as "exposure to varied ways of thinking," "promotion of development in classes as a whole through inter-class competition," and "group educational activities." Furthermore, many such schools face difficulties maintaining separate classes for each grade and must resort to implementing mixed-grade classes. The elements from Table 1 noted above are crucial parts of school education, and failure of small-scale schools to adequately provide these elements has led to pressure to reevaluate their educational efforts. From a lifestyle perspective, the small-scale school experience may also hinder "opportunities for peers to challenge each other to grow through friendly competition" and the ability of schools to "reorganize students into different classes." At many small-scale schools located in rural areas, children spend their entire schooling experience from kindergarten through lower secondary school with a largely static set of peer relationships. In a majority of small communities, the local kindergarten, elementary school, and lower secondary school may all be physically adjacent, meaning that children commuting to such schools may spend their school lives from kindergarten through lower secondary school in a group of one to five or six peers with static relationships. The periods of childhood and adolescence that correspond to time spent in elementary and lower secondary school are critical periods of life; during these periods, individuals develop personal identities partly informed by the acquisition of social skills, including the ability to form and participate in peer groups by interacting with a diverse set of similarly-aged individuals. Spending these periods of life in an environment with a limited number of peers and static relationships may severely limit a child's potential for growth. These are factors that must be taken into account when reevaluating the proper design of small-scale schools.

It was with these considerations in mind that MEXT released its "Handbook Regarding Suitable Scale and Placement of Public Elementary and Lower Secondary Schools" (KōritsuShōgakkō, Chūgakkō no TekiseiKibo, TekiseiHaichitōnikansuruTebiki) (hereafter, "the handbook"), on January 27, 2015. The handbook clarified national standards for suitable educational environments and urged each prefectural board of education to evaluate factors important to the formation of effective schools that are appropriate to each local community's situation (Ministry, 2015).

As we have discussed, an extremely large number of issues surrounding small-scale schools in rural areas has become apparent in recent years. One frequently-employed solution to these issues recently has been to close down some elementary and lower secondary schools and consolidate their student bodies elsewhere. In fact, the handbook proposes school consolidation as a preferred means to achieve suitable scale and placement of schools. Of course, reasons for closing schools and consolidating students in fewer locations include the reduction of costs associated with employing teachers as well as financial considerations regarding school administration. However, as discussed earlier, one other major consideration behind consolidation is the desire to provide children with opportunities to form a wide variety of relationships. Thus, we can say that in cases where consolidation is considered as a means to better facilitate such opportunities, the decision to close down a community school and consolidate elsewhere is not one that has an exclusively negative impact on children attending that school. However, consolidation of elementary and lower secondary schools also brings about several disadvantages.

The largest disadvantage of consolidation is the loss of the school's historical or cultural value in the region and community where it is located. As Yanagi (2005) points out, schools – and in particular, elementary schools which have a long history in their communities – are not simply an educational organ of their regions or communities. Rather, they often play a central role in local residents' sense of belonging, and they serve as a symbolic presence that represents the region, village, or community itself. Regions and communities develop around their schools, and schools serve a central role, tying their communities together. In other words, ensuring the continuation of a region's school also serves to preserve that region's history and traditions. Schools are, of course, facilities primarily meant to serve children, and it is necessary to consider their preservation in terms of the opportunities for development and growth they can provide to children. However, schools also hold cultural value for their communities, and we should not be quick to dismiss that fact when determining a school's fate.

From the perspectives outlined above, it is clear that rural societies appear to be facing a choice between mutually exclusive alternatives. They are being pressed upon either to embrace consolidation and thereby gain the benefits of scale (at the cost of discarding the community's local identity and cultural value) or to forgo consolidation and thereby renounce the benefits of scale in order to preserve cultural value. Given this dilemma, there is no doubt that a solution allowing for both preservation of the school's cultural value as well as the benefits of scale (or, in other words, the capability to continue providing opportunities to form a wide variety of relationships) could be considered the best possible option for both children and the regions or communities in which the schools are situated. Our research therefore determined to build an environment capable of providing children attending rural, small-scale schools with opportunities to form a wider variety of interpersonal relationships through the use of Information and Communication Technology (ICT). Further, we selected schools from Fukui Prefecture, which contains a significant number of rural areas, as locations to test the environment we developed. This report aims to evaluate issues pertinent to the construction of this type of environment, as well as to clarify issues we encountered during operation, and discuss the overall results we obtained.
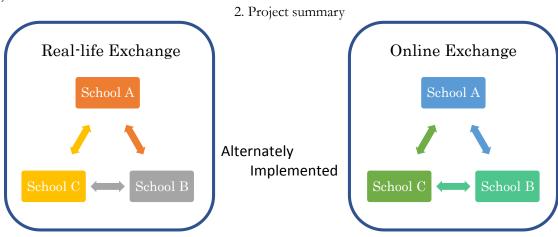
2. Project summary

Figure 1. Project outline.

With the current situation and issues described above in mind, we attempted to create a system and environment that could provide children with opportunities to build diverse relationships while leaving schools intact within the regions and communities where they are rooted. The system and environment were then utilized by children at schools that had been selected to participate in our research. A major issue of small-scale schools is the limitation they impose on relationships. Therefore, for the purposes of our project, we selected three small-scale schools within Fukui Prefecture and formulated a plan to create an exchange between the schools by keeping them continually connected via the Internet. Specifically, we selected multiple rural schools implementing mixed-grade classes, and we linked these schools with a continuously-active network utilizing a web conference system. In doing so, we attempted to build an environment for frequent inter-school exchange. A model of our project is provided in Figure 1. Some characteristics of our project are as follows: In addition to providing continuous exchange over the Internet via the web conference system, we also prepared opportunities for the students of all three schools to interact in real life.

We feel that exchange that only takes place through daily ICT use may result in relationships that lack a sense of reality. Furthermore, we believe that a project limited to ICT use risks being reduced to research for the sake of research, rather than an effort toward developing a practical application. However, we were concerned that real-life interactions taking place only a few times per year may be construed by participating children as special events, rather than elements contributing to a consistent, long-term relationship. With that concern in mind, we proceeded to design an environment that would allow children studying at rural, small-scale schools to form a wider range of relationships by providing them with alternating opportunities for both online and real-life exchange.

Attempts to organize real-life exchange opportunities across multiple schools may be hampered by numerous obstacles, such as the individual circumstances of each school, difficulties in coordinating transportation for students, school responsibility for student safety during transportation, and additional workload imposed on school faculty. Therefore, for our project, we decided to select small-scale schools already taking part in an inter-school exchange program that is being carried out by the Fukui Prefecture Board of Education known as the "Program for the Promotion of Joint Classes Among Small-Scale Schools." This enabled us to provide both the online exchange environment at the heart of our project and real-life exchange opportunities arranged by the board of education's existing program.

Thus, we selected three elementary schools located in Fukui Prefecture that participate in the board of education's "Program for the Promotion of Joint Classes Among Small-Scale Schools" to be a part of our project. For the purposes of the project, the schools were designated as Elementary School A, Elementary School B, and Elementary School C. A summary of the three schools can be found in Table 2. A web conference system (hereafter, "the system"), was installed in each of the three schools and used to maintain a continuous link among them. The system utilized the "Fresh Voice" software developed by Advanced Network Systems Co., Ltd., of Tokyo, Japan. A server was established inside the University of Fukui, to which the client machines in each elementary school were connected. For the sake of security, the server installed at the university was not connected to the university network,

Table 2. Summary of participating schools (at time operation commenced)

	Elementary School A	Elementary School A	Elementary School A
First Grade	5	3	0
Second Grade	8	1	3
Third Grade	4	1	5
Fourth Grade	6	2	1
Fifth Grade	6	3	1
Sixth Grade	8	1	3
Overall Enrollment	37	11	13
Location of Systems Installed	1F Outside Faculty Room	1F Inside School Library	1F Hallway

but rather directly to private connection lines that were installed at each school.

As the experiment was intended to provide the children at each participating school with opportunities to build a wider range of relationships through the use of a web conference system, we chose to install terminals not inside classrooms, but rather in places where a significant number of children were likely to spend time during breaks between classes. At the beginning of the day, each school booted up its terminals, and a connection was established with the other schools. The connection remained in continuous operation until it was shut down at the end of each school day, after the school's students had gone home. Figure 2 depicts one of the terminals used in our project as part of the web conference system. Additionally, while this online collaboration experiment was taking place, the students from all three schools also gathered together at one of the schools several times per term and held joint classes(See Figure 3).

3. Issues during creation of the project environment

Throughout this report, we aim to clarify issues related to implementation and operation of a collaborative network system in small-scale schools.

First, we will examine possible concerns during the initial implementation of this type of system. We identified the following three areas of potential difficulty during system implementation and creation of the project environment:

3.1 An understanding of each school's needs

A unique characteristic of our ICT project was the attempt to coordinate across three elementary schools sharing a similar situation. However, even in cases like ours, where the makeup of and issues faced by each school were quite similar, the schools were, of course, not identical. Each school differed in the number of children enrolled as well as the characteristics of the community in which it was situated, and each school perceived itself as facing different challenges. In order to effect a unified project across three schools, it is critical for the organizing entity to have a nuanced understanding of the current state of and challenges faced by each school, and then to devise a project that serves to address the schools' common issues based on that understanding.

3.2 Terminal placement

The aim of this project was to create a system that allows children in small-scale schools to form a wider range of relationships without having to abandon the other inherent advantages offered by small-scale schools. Such a system would have to be able to, via ICT, facilitate natural exchange with children from other schools in real time. Therefore, when selecting a location for our system's terminals, we chose not to place them inside a designated classroom; instead, we prioritized placement in more generally accessible locations, such as places where a large number of children would be likely to spend their free time during breaks between classes. However, at the same time, because the system was fundamentally intended as a means for children to interact with peers of similar age, schools where the system was to be implemented expressed a strong preference for terminals to be located in areas where appropriate teacher supervision could be maintained, and this became a critical factor in determining system placement. These two conditions posed a challenge, as we determined that there were only a limited number of places at each school that met both requirements (a large student presence during break times and sufficient proximity to teacher supervision). Determining appropriate terminal locations was one of the major hurdles in our project's attempt to construct an effective environment for social exchange.

3.3 The network

A unique challenge of small-scale schools involves their computer network configurations, which may differ from those in place at standard elementary schools. One school that participated in our project, Elementary School B, was technically a combined kindergarten, elementary, and lower secondary school. Because of that, the school's computer systems were linked to the network of its municipality, Fukui City, specifically dedicated to lower secondary schools, rather than the city's elementary school network. This forced us to work out a way to set up the components of our project within not only the elementary school network but the lower secondary school network as well. An additional challenge we encountered involved physically connecting terminals to the appropriate network. Because our system was fundamentally designed for use by children, it was meant to be connected directly to student-accessible networks. However, because of the previously described need to place terminals in locations with sufficient teacher supervision, this led to some terminals being placed in locations only within reach of faculty network connections. For example, at Elementary School A, one terminal was placed directly outside the school's faculty room on the school's first floor. In this location, the terminal was only within reasonable reach of the faculty network. In Elementary School A, no classrooms are located on the first floor, and thus the need for children to access information terminals on that floor had never been anticipated. Only faculty network connections were available on that floor, while student network connections were available on floors two and above. Therefore, for the purposes of our project, we were required to carry out minor renovations at the school in order to run a network line from the student network on the second floor down to the first floor.

4. Results of the project and issues encountered during operation

To evaluate the results of and issues encountered during our project, we conducted an oral survey with one administrator from each of the three schools (for a total of three adult survey participants) and three upper-grade students from each of the three schools (for a total of nine child survey participants). Administrator and student surveys were conducted separately and at different points in time.

4.1 Project benefits

We determined two benefits arising from our use of a collaborative network to link the three schools: 4.1.1 Increased options available to children during break times, and an increased feeling of connection with friends Because small-scale schools have few students in each grade and fixed class configurations, children at these schools inevitably spend all break times with a quite limited and unchanging set of classmates. During our testing phase, once a continuously-active system was in place at each school, we observed that during each break time, children would gather in front of the systems and check what was happening at the other schools. Surveyed administrators shared comments regarding this observation, such as "Children enjoy discovering new things and have a strong desire to become familiar with them" (Administrator A), and "The idea of conversing in real time with students at another school is still a fresh and unusual concept to children of this age, and, if their timing is right, this system allows them to actually experience those kinds of interactions during their breaks..." (Administrator C). We, too, were able to actually observe scenes of the children gathered in front of the systems during each break. Furthermore, we were able to hear from the children themselves how they enjoyed the experience of using the system to speak with friends in distant locations. They expressed sentiments such as. "It's fun to speak with friends that are in places far away" (Student C); "It feels really mysterious and is even more interesting than talking with that person in real life" (Student D); and "It felt really exciting" (Student B). Other comments, such as, "After I'd used it a few times, I found I was always wondering what was going on in the other schools and wanted to check during every break" (Student B) and "I'd check the system because I always wanted to see if there was anyone using it on the other end" (Student F) suggest that as the students used the system, they began feeling a sense of camaraderie with the students located at other schools. Additionally, we heard comments from administrators such as "Pretty soon, the students were beginning to make frequent comments like, 'I wonder what so-and-so at such-and-such elementary school would say about that?'" (Administrator A) and "Students would say things like, 'I'm gonna ask so-and-so at the other school about that'" (Administrator B). These suggested that, as system use continued, psychological distance between children at the three schools was demonstrably reduced.

4.1.2 Expansion and diversification of class activities

As outlined in MEXT's "Advantages and Disadvantages of Schools by Scale (Examples)," one major disadvantage of small-scale schools is the reduced availability of learning opportunities. Some classes may be composed of just three or four students, making exchange of opinions and debate more difficult. Among the schools involved in our project, some featured entire grades composed of only a single student each. For such children, not only is there no opportunity to engage in debates or exchanges of opinions with peers; there is no opportunity even to hear thoughts from anyone else of their own age. The system developed for this project can be used anywhere. All it requires is installation of specialized software and the presence of a unified network between the locations to be connected. Because of this, the system provided an easy way to conduct remote classes in real-time, only requiring teachers at the three schools to prepare laptop computers with the appropriate software. In fact, remote classes became another regular feature of our project. During our survey, we heard from administrators that remote classes conducted in real time had been extremely effective in the eyes of faculty members, with comments such as "Thanks to this system, we have been able to expand our class activities, and that has been a great boon to our school. Specifically, before we had this system, it was difficult for us to provide the children with a wide variety of opinions to listen to and exchange opinions with as a means of rethinking and reformulating their own beliefs. Now, with this system, those types of opportunities have become much simpler to provide…" (Administrator C), and "We hold six joint classes per year. If the children hadn't had a chance to meet each other through the network beforehand, we would have had to begin joint classes by letting everyone get to know each other and become comfortable with each other. [...] We would not have been able to delve as deeply into more meaningful content. Because the schools were in contact with each other before those joint classes took place, we were able to make the real-life interactions more meaningful" (Administrator A). Furthermore, regarding the relationships that formed among children, we heard responses such as "Perhaps it is because the children are speaking with each other during break times, but I find that we are able to execute class debates via camera as smoothly as if we were having a real-life class together" (Administrator A) and "Because of our small class sizes, the system works well in the classroom, too. We can fit all students on screen in easy-to-see detail, so it feels like everyone really is part of the same class" (Administrator B). These comments suggest that use of the system to conduct classes in addition to its general availability during break time may contribute to a reduced sense of distance between the children. The children themselves expressed positive feelings regarding these classes, with comments such as "Remote classes (using the system) are a lot of fun" (Students A, B, D); "It's good because you can hear a lot of different thoughts" (Students C, E, G); and

"When it's not just me in class, I can see that there are other students that don't understand some things, and that makes me happy" (Student H); all suggesting the importance of access to opinions from a greater range of individuals to quality class design.

4.2 Issues in system operation during the project

As seen in previous sections, advantages of our system were generally recognized by both students and administrators. However, we also discovered several issues in regard to operation. We have divided issues as expressed during the oral survey into two major categories:

4.2.1 Differing methods of use according to varied needs of participating schools

Although all participating schools shared a goal of providing children with opportunities to form a wide range of relationships by way of a web conference system environment, each school demonstrated differing needs (as touched upon during our earlier discussion of issues encountered during implementation), and the way each school chose to use the system differed as well. We found that while one school chose to use the system explicitly as defined by the project and no further, limiting its use to exchange between children during break times and special activities, another school chose to use the system to conduct joint classes in coordination with the other schools, or even to expand use of the system to include interactions with other members of the community, and thereby expand classroom activities even further. Sentiments such as "We've been provided with this great system, so we'd like to use it in our classes," and "I think the biggest problem at small-scale schools like ours is that children lack exposure to diverse opinions. A system like this allows us to compensate for that disadvantage" (both by Administrator B), as well as "When we conduct classes in connection with other schools, the children's level of concentration is completely different. They become more serious and excited about class," and "If all this requires is a computer and a camera, we can take this system to community centers and regional associations, so that students can hear from people in the community in real time. If we do that, even small elementary schools like ours can provide wide-ranging classes" (both by Administrator C), show that some schools took a relatively progressive stance on the use of this system during classes. On the other hand, we observed that some schools may be less motivated to use the system in these ways, as shown by comments such as "Being able to use this system in class is an attractive proposition to a small school, but because joint classes involve another party, they require content and class pacing to be coordinated in detail among all participants on a daily basis. I'm worried about the additional burden that would place on teachers" (Administrator A). Though all schools acknowledge the benefit of being able to easily conduct remote classes, we cannot ignore the reality that such classes come with scheduling concerns, curriculum adjustment, and additional faculty burden. This would not be an issue if, aside from the goal to provide children with opportunities to form varied human relationships, the participating schools all shared an additional common goal of using the system to achieve a wider variety of class activities; however, several obstacles hinder this type of use when only one school seeks to pursue it.

4.2.2 Student use of the system

One difficulty encountered in our experiment was due to our attempt to coordinate across three different schools. Each school, of course, has its own unique style and manner of operation, and we discovered that it can be quite difficult to reconcile such variations. In our case, one major hurdle was in scheduling differences. Of the three schools that participated in our research, one differed from the other two in that it used a daily time schedule typical of lower secondary schools, rather than that of elementary schools. Because of this difference, student break times at one school were not consistent with break times at the other two, and this led to instances where students at the differing school would gather in front of the system during breaks only to find that no students were currently using the system at the other two schools. Comments such as "When I go to the computer and someone's there, it's fun, and it makes me happy, so I want to go again" (Student B); "No matter when I go, no one is there on the other side, so I don't really know why we even have this system" (Student H); and "At first, I thought it sounded interesting and I wanted to check it out, but no one is ever there, so I mostly stopped going" (Student I) demonstrate that children who gathered in front of the system when it was first introduced tended to gradually stop doing so if they consistently faced situations in which there was no one available to interact with on the other side. This same problem manifested at the other two schools: If children consistently found that no one from the other schools was present on the monitor when they decided to use the system, their rate of usage inevitably dropped over time. Comments from school faculty members revealed the importance of having children actually experience interaction with each other

when using the system, as well as the potential need to devise incentives to encourage children to visit the system.

Such comments included, "We've been given this fascinating system to use, so now it's up to the teachers to come up with ways to get the students to use it. However, we've been struggling to come up with good ideas" (Administrator B), and "In order to get children to visit the system, we prepared a number of incentives" (Administrator A). When system use did decline approximately two months into operation of the experiment, teachers at each school introduced methods to encourage continued use. These included placing interesting objects in front of the camera so that children would have something to look at even if no one was currently using the system on the other side. Placed objects included a hyacinth bulb being cultivated at one school and an aquarium containing one school's pet frog. Another method devised by teachers was the creation of a remote competition wherein student-made quiz questions were placed in front of the camera daily, and children at the other schools were challenged to find the answers. These innovations markedly increased student use of the system. However, while some children expressed positive sentiments about the innovations, such as "The quizzes were interesting. There were a lot of hard questions, and I wanted to be able to answer them, because if our school wasn't able to answer, it felt like we'd lost to the other schools" (Student A) and "Normally I wouldn't care about a hyacinth, but just because it was there on the other school's camera, I wanted to know how it's doing and went to check on it" (Student D), a large number of less supportive opinions were also expressed, such as "I feel like if people aren't there, it just isn't fun" (Student B); "If no one's there on the other end, I'm gonna play with my friends at my own school instead" (Student H); and "It takes a lot of effort to go to where the system is, so if I go all the way over there and no one is on the other end, it feels like I've wasted my time" (Student E). These opinions seem to indicate that children recognize a certain amount of meaning in the ability to interact with remote friends. At the same time, these comments suggest that if no friends are available on the other end(s) of the system, children find no value in using it. Taking into account the goal of this project, this conclusion reached by the students seems quite obvious. However, it also suggests to us the importance of considering unified time schedules across all participating schools when implementing this type of system. It also suggests a need to brainstorm a variety of incentives that can be used to encourage students to regularly use the system.

5. Significance and future areas of study

5.1 Significance of the research

The defining characteristic of our research was the creation of a system able to maintain opportunities for children at small-scale schools to form varied interpersonal relationships by creating a continuous link between three physically remote elementary schools via web conference terminals. Through the use of ICT, children attending small-scale schools can be provided with opportunities to engage in daily exchange with their counterparts at other schools. This project had two major points of significance. The first point was this project's search for a solution to the issue of limited relationship-forming opportunities at small-scale schools that did not involve consolidation. The findings summarized by MEXT and comments from surveyed teachers clearly indicate the disadvantages small-scale schools suffer in terms of reduced opportunities for academic and personal growth because of limited student population. However, survey responses obtained during our study suggest that implementation of the system we have designed may enable simple execution of remote classes and a broader range of class activities at small-scale schools. Furthermore, children themselves indicated that they were extremely excited about the prospect of gathering in front of a system of this type and finding another student waiting to communicate with them on the other side. These findings both suggest that ICT can be used to affect increased formation of interpersonal relationships in a school environment. The project's second point of significance is in its use of ICT in the students' daily activities at school. The most conventional use of ICT in schools is that which occurs during classes, where the technology serves as a tool to provide more varied and distinctive educational activities. In our experiment as well, the web conference system was used as a tool to conduct classroom activities. However, the delivery of knowledge inside a classroom environment is not the sole purpose of school education. Another crucial function expected of the school is to impart social skills, including ample opportunities to form relationships by way of interaction with friends and classmates during special activities, break times, and so on. Thus far, there have been very few research papers or case studies focused on the use of ICT in schools in a capacity other than for classroom activities. Therefore, our research may be significant in its implementation of ICT in schools as a tool to help form relationships outside of class, as well as in its attempt to determine whether a continuous link maintained between multiple schools will lead to acquisition of better developed social skills in children.

5.2 Future areas of study

This report summarizes the results of an oral survey regarding the issues encountered and benefits obtained when carrying out a collaborative ICT project across three schools, from the standpoint of actual users of the system. Numerous benefits obtained through operation of this system were acknowledged, but at the same time, numerous issues were also brought to light. Moving forward, it will be necessary to contemplate means to address the problems we have identified. Furthermore, our findings suggest that a general spread of ICT systems throughout regions may make it more feasible to carry out educational opportunities that connect schools with their communities by way of ICT. Efforts to identify such opportunities may lead to continued improvement of education at small-scale schools.

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