Journal of the Korea Society of Mathematical Education Series D:
Research in Mathematical Education
Vol. 1, No. 1, July 1997, 61–74

韓國數學教育學會誌 시리즈 D:
<數學教育研究>
제 1 권 제 1 호 1997 년 7 월, 61–74

The Current Status of Computer Usage in Korean Schools

HWANG, HYE JEANG
Korean Educational Development Institute, 92-6 Umyeon-dong, Seocho-gu,
Seoul 137-791, Korea

Currently, school computer education has turned to multimedia education, and the related policies are run by each regional authority of education. School principals and parents show strong interest on computer education and the movement into multimedia education as well. In current school education it also seems that computer use is being integrated into all subjects.

1. COMPUTER USAGE IN SCHOOL CURRICULUM

- *Computer education as compulsory and elective courses*

Computer education is provided in both compulsory and elective courses under the 6th National Curriculum.

Table 1. Curriculum Contents of Computer as an Elective Course

School level	Subject areas	Grades	Contents
Primary	Optional courses	3–6	not suggested
Middle	Computer Science	7–9	understanding computers using computers computer and life
High	Information-Industry	10–12	information and industry information processing and computer using computers programming information communication and new media

Last year (1996), Multimedia Education Research Center (MERC) analyzed the current status of computer education in primary and secondary schools. Its purpose was to recommend policies to aid effective and balanced improvement in school computer education. To accomplish this, a survey was conducted to 4,860 teachers and students.

The response rate was 85.3%. The major areas of the analysis are curriculum, teaching staff, students, hardware, software, and support systems.

Several major problems within that condition were indicated as follows:

- The content tends to be redundant among the school levels,
- The content tends to illustrate the computer rather than to guide use of the computers for teaching-learning aids,
- The content is not appropriate for preparing students for the information society, and
- Some students are not provided with on opportunity for learning with and about computers.

Table 2. Curriculum Contents of Computer as a Compulsory Course

School level	Subject areas	Compulsory course for tracks	Grades	Contents
Primary	Practical Arts		5	handling computer managing computer
			6	writing by computer use
Middle	Technology and Industry		1	computer component computer use
High	Vocational Education and Home Economics	Technology	11–12	introduction to information communication computer and information communication computer use
		Commerce	11–12	comp uter utility word processor
	Mathematics	**Mathematics I***	*	**algorithm and flowchart**
		Practical Mathematics**	**	**calculator and computer**

*) Grades 11 & 12 for literacy track, grade 11 for science track

**) Grades 11 & 12 for vocation track

- *Computer use as an instructional tool in mathematics*

The guidelines on using computers including calculators as an instructional tool is described in the 'method' section of middle and high school mathematics curriculum as

follows:

Primary School—Not mentioned.

Middle School—It is recommended that calculators or computers be used to do complicated computation rather than to improve computational skills or to enhance problem-solving ability, and so on in teaching and learning situation.

High School—It is recommended that calculators or computers be used to do complicated computation or to enhance problem-solving ability, and so on in teaching and learning situation.

As shown above, in mathematics the use of technological devices such as calculators and computers as an instructional tool is not essential but just elective according to individual teachers' judgements and decisions on their use in class.

2. HARDWARE

As computers are updated in the markets and simultaneously multimedia software is developed, school computers need to be updated, which was pointed out to be the most serious issue (See Table 3, Table 4 and Table 5).

Table 3. The Number of Computers Per School According to School Level

School level	Average number of computers per school	Average number of schools responded
Primary	35.2	112
Middle	38.3	145
High	41.7	125
Total	**38.5**	382

Table 4. The Number of Computers Per School According to Computer Type

Computer type	Average number of computers per school
8bit	0.4 (1.1%)
XT	**15.9 (41.2%)**
286	4.7 (12.3%)
386	5.7 (14.8%)
486	7.2 (18.8%)
586	4.4 (11.4%)
Mackintosh	0.2 (0.4%)
Total	38.5 (100.0%)

Table 5. Peripheral Equipments per School

School level	Average number of modems per school	Number of schools having exclusive telephone lines for modem	Average number of CD-ROM drives per school	Average number of printers per school	Number of schools having LAN card	Number of schools having LCD projection panel	Number of schools responded
Primary	1.2	12(10.7%)	1.4	4.5	50(44.6%)	3	112
Middle	1.5	18(12.5%)	1.8	5.7	48(33.1%)	7	145
High	1.8	23(18.4%)	3.0	8.0	45(36.0%)	9	125
Total	1.5	53(13.9%)	2.1	6.1	143(37.4%)	19	382

3. SOFTWARE

• *CAI programs developed in MERC*

The project of annual CAI research and development first started in 1988 in MERC under the sponsorship of the Ministry of Education, and it was launched in accordance with the following national policies:

"School Computer Education Enforcement Plan"(1987),
"School Computer Education Improvement Plan"(1992), and
"School Computer Education Support & Promotion Enforcement Plan"(1994).

The major goals of the project are as follows:

- to develop students' capability for computer use,
- to enhance teaching and learning experience with computers, and
- to computerize teachers' administrative work.

In the project, 594 programs were produced by 1995 (90 programs per year) and another 70 programs were produced last year 1996. The number of mathematical programs among 664 programs are 71, 47, and 25 in each of the elementary, middle, and high school levels.

Especially in 1995 three software packages were produced for the purpose of enhancing students' thinking skills in mathematical problem solving, scientific inquiry, and logical thinking. The 70 programs in 1996 include two kinds of CD titles: one for the purpose of English education in primary schools and the other for environmental

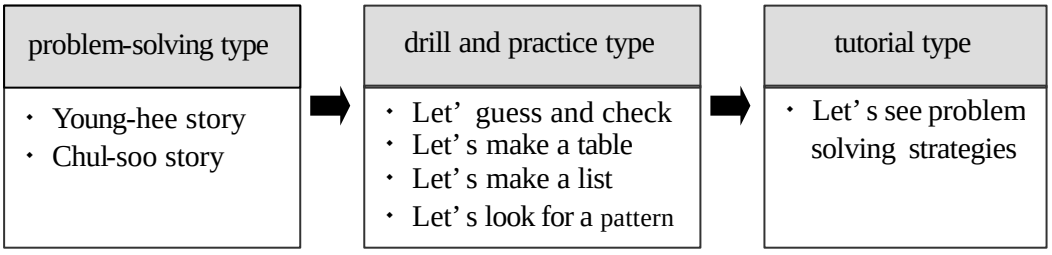
education in secondary schools. From 1995, some of the above programs have been developed by local college professors under the auspices of MERC.

- *Introduction on "Mathematics in the Story" program*

To enhance fourth to sixth graders' mathematical problem solving skills in elementary schools, a mathematical problem-solving skill CAI program including a users' guide was developed as a program package comprised of 9HD diskettes and recommended to be installed in hard disk drives.

In the program development process, three types of problems such autine, non-routine, and real-life were used. Four stages of problem-solving including understanding a problem, planning to solve the problem, carrying out the plan, and looking back the solution were used; and four basic problem-solving strategies including guess and check, making a table, making a list, and looking for a pattern were used.

The package consist of seven programs and its main title is "*Mathematics in the Story*". It has three types of CAI programs as follows:



Unlike the method of traditional mathematics instruction with/without computer use, problem-solving activity through the package is done by using problem-solving, drill and practice, and tutorial programs in order, based on the theory of discovery learning method. To sum up, while giving students some opportunity to solve a given mathematical problem using an appropriate problem-solving strategy by themselves, the program gives a chance for them to develop their power of logical thinking skills, and their interest in mathematics study.

- *Educational Software Contest*

For the purpose of distribution of quality educational software, the Educational Software Contest has been held under the support of MERC every year during the last five years(see Table 6). The object is for teachers who teach liberal arts, mathematics, science, social studies, commercials, and extra subjects in schools to be able to design

and develop software for themselves.

The intended benefits are:

- To enrich the environment in which educational software is developed
- To lead out teachers to participate in computer education
- To maximize the use of computers in education
- To activate school computer education.

The contest uses the following two procedures:

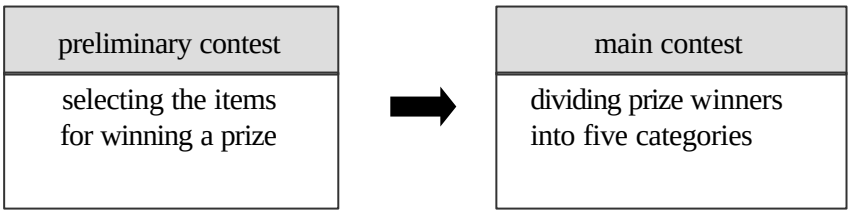


Table 6. The Number of CAI Programs Shown on the Contest

Year	1st (1992)	2nd (1993)	3rd (1994)	4th (1995)	5th (1996)	Total
Number of programs shown on preliminary contest	120	254	557	930	1,532	3,393
Number of programs shown on main contest (percentile of prize winners)	91(75%)	150(59%)	151(27%)	250(20%)	297(19%)	937
Number of math programs winning a prize	21	42	34	65	56	192

Besides KEDI, several industries has been developing CAI programs since the end of the 1980s (see Table 7). According to the findings of MERC's report, the average number of CAI programs each school has is 129.5(elementary: 162.5, middle: 139.1, high: 83.3) and the average number of mathematical CAI programs is 27.5(21%). A majority of programs those schools have are the ones developed in MERC and by teachers who won a prize in the Educational Software Contest(MERC: 58.3%, winning pieces of work in Educational Software Contest: 24.0%). Anyway, since a couple of years ago, MERC, Educational Software Contest participants and industries have begun to develop some quality programs of CD-ROM titles used in multimedia environments.

Table 7. The Number of Mathematical CAI Programs

School level	Elementary	Middle	High	Total
MERC (1989–1996)	71	47	25	143
Educational contest (1992–1996)	141	20	31	192
Three industries (recent)	14	1	3	18
Total	226	68	59	353

The mathematical CAI programs developed by MERC researchers, teachers, etc. are used in schools for the following educational purpose (see Table 8):

- Understanding of new mathematical concepts and principles
- Review of prerequisite knowledge through diagnostic evaluation
- Drill and practice through solving similar types of problems
- Reinforcement on achieved concepts through formative evaluation
- Enhancing problem-solving skills (through games)
- Summative evaluation
- An instructional tool for teaching such concepts as functions, graphs, data collection

The coming trends in using computers as a tool in mathematics classes are as follows:

- Visual learning of mathematics using LOGO
- Dynamic learning of Geometry using Geometer's SketchPad, or Cabri Geometry
- Active learning of mathematics using Spreadsheets
- Effective learning of mathematics using symbolic software such as Maple, Mathematica
- Effective learning of mathematics using graphing calculators

In 1994, KEDI conducted a study on the methods of mathematical instruction using computers in elementary and middle school. The purposes of the study were to present methods of using computers to improve the quality of mathematics instruction, to propose directions for instructional design needed for the development of mathematics educational softwares, and to improve the mathematics instructional methods in elementary and middle school. A survey was conducted of 1200 mathematics teachers in primary school and 60 teachers in middle school. The response rate was 58% and 67.9% respectively. Refer to Table 8, Table 10, and Table 14.

Table 8. The Purpose on Using Mathematics CAI Programs

School level	Diagnostic evaluation	Formative evaluation	Under-standing of concepts	Skill proficiency	Summative evaluation	Problem solving skills	Total
Primary	74 (14.5%)	96 (18.8%)	90 (17.6%)	94 (18.4%)	74 (14.5%)	83 (16.2%)	511 (100%)
Middle	4 (1.7%)	65 (27.4%)	72 (30.4%)	53 (22.4%)	35 (14.8%)	8 (3.4%)	237 (100%)

4. TEACHERS AND STUDENTS

Most teachers including mathematics teachers have no experience in using computers in their classes yet (see Table 9 and Table 10). The main reasons are that they consider their ability for computer use to be low, and they have no confidence in managing classes using computers (see Table 11). Another important reason is that in their judgement there is no appropriate, quality software (see Table 12). They believe that teaching with traditional methods is more effective than teaching with a computer. In spite of teachers' negative responses on using computers, most teachers who have ever used computers in their classes have convergent views about the effects on students' mathematics learning (see Table 13 and Table 14).

Table 9. General Teachers' Experience of Computer Use in Their Classes[1]

School level	Primary	Middle	High	Total
Experience	215(38.5%)	93(15.1%)	64(11.6%)	372(21.6%)
No experience	344(61.5%)	521(84.9%)	488(88.4%)	1,353(**78.4**%)
Total	559(100.0%)	614(100.0%)	552(100.0%)	1,725(100.0%)

Table 10. Mathematics Teachers' Experience of Computer Use in Their Classes

School level	never used	less than 5 times /semester	5–10 times /semester	more than 10 times /semester	no response	Total
Primary	185(26.5%)	278(39.9%)	198(28.4%)	33(4.7%)	2(0.3%)	696(100%)
Middle	173(**42.4**%)	126(30.7%)	105(25.6%)	3(0.7%)	3(0.7%)	410(100%)

[1] From Table 9 to Table 14, the figures are the numbers of teachers responded.

Table 11. General Teachers' Self-Evaluation of Ability in Utilizing Computers

School level		Primary	Middle	High	Total
I know about computers well	strongly agree	16(2.9%)	14(2.3%)	16(2.9%)	46(2.7%)
	agree	129(23.0%)	153(25.2%)	156(28.1%)	438(25.4%)
	undecided	320(57.1%)	355(58.5%)	308(55.5%)	983(**57.1**%)
	disagree	95(17.0%)	85(14.0%)	75(13.5%)	255(14.8%)
	strongly disagree	560(100.0%)	607(100.0%)	555(100.0%)	1,722(100.0%)
I can teach using a computer	strongly agree	19(3.5%)	31(5.1%)	22(4.1%)	72(4.3%)
	agree	131(24.4%)	93(15.6%)	82(15.2%)	306(18.3%)
	undecided	211(39.3%)	205(34.3%)	177(32.8%)	593(**35.4**%)
	disagree	176(32.8%)	269(45.0%)	258(47.9%)	703(**42.0**%)
	strongly disagree	537(100.0%)	598(100.0%)	539(100.0%)	1,674(100.0%)

Table 12. General Teachers' Evaluation on Quality of CAI Programs

School level	Primary	Middle	High	Total
Very good	6(1.1%)	3(0.5%)	6(1.2%)	15(0.9%)
Good	107(19.7%)	73(12.5%)	58(10.8%)	238(14.3%)
Bad	259(47.6%)	238(40.7%)	180(33.6%)	677(**40.7**%)
Very bad	109(20.0%)	148(25.3%)	167(31.2%)	424(25.5%)
I don't know	63(11.6%)	123(21.0%)	124(23.2%)	310(18.6%)
Total	544(100.0%)	585(100.0%)	535(100.0%)	1664(100.0%)

Table 13. General Teachers' Evaluation on Students' Learning Effect on Computer Use

School level		Primary	Middle	High	Total
Student achievement	Very high	47(19.3%)	27(24.5%)	16(18.2%)	90(20.4%)
	High	146(59.8%)	57(51.8%)	53(60.2%)	256(**57.8**%)
	Low	44(18.0%)	14(12.8%)	9(10.2%)	67(15.2%)
	Very low	7(2.9%)	12(10.9%)	10(11.4%)	29(6.6%)
	Total	244(100.0%)	110(100.0%)	88(100.0%)	442(100.0%)
Student interest	**Very high**	159(65.2%)	52(47.2%)	36(41.4%)	247(**56.0**%)
	High	76(31.1%)	45(40.9%)	44(50.6%)	165(37.4%)
	Low	9(3.7%)	7(6.4%)	3(3.4%)	19(4.3%)
	Very low	0(0.0%)	6(5.5%)	4(4.6%)	10(2.3%)
	Total	244(100.0%)	110(100.0%)	87(100.0%)	441(100.0%)

Table 14. Mathematics Teachers Evaluation on Students Learning Effect on Computer Use

School level	Useful	I don't know	Not useful	Total
Primary	352(68.8%)	158(30.9%)	1(0.2%)	511(100%)
Middle	145(61.2%)	90(38.0%)	2(0.2%)	237(100%)

Although students themselves still consider the degree of their understanding of computers as low (see Table 15), they become more knowledgeable about and positive towards computers through their experience in computer education or computer use in learning situations. Furthermore, they become positive about having computer education and regarded the use of computers and computer education as highly important (see Table 16).

Table 15. The Degree of Students Understanding on Computers[2]

School level	Primary	Middle	High	Total
Very high	41(6.4%)	45(6.8%)	32(4.8%)	118(6.0%)
High	239(37.7%)	205(31.1%)	148(22.0%)	592(30.1%)
Low	**285(45.0%)**	**311(47.2%)**	**318(47.2%)**	**914(46.5%)**
Very low	69(10.9%)	98(14.9%)	175(26.0%)	342(17.4%)
Total	634(100.0%)	659(100.0%)	673(100.0%)	1,966(100.0%)

Table 16. The Degree of Students Recognition on the Importance of Computer Use

School level		Primary	Middle	High	Total
*	**Strongly agree**	**264(41.9%)**	**312(47.8%)**	**341(51.1%)**	**917(47.0%)**
	Agree	215(34.1%)	225(34.4%)	206(30.9%)	646(33.1%)
	Disagree	95(15.1%)	66(10.1%)	87(13.0%)	248(12.7%)
	Strongly Disagree	56(8.9%)	50(7.7%)	33(5.0%)	139(7.2%)
	Total	630(100.0%)	653(100.0%)	667(100.0%)	1,950(100.0%)
**	**Strongly agree**	**159(65.2%)**	**52(47.2%)**	**36(41.4%)**	**1,489(76.6%)**
	Agree	76(31.1%)	45(40.9%)	44(50.6%)	380(19.6%)
	Disagree	9(3.7%)	7(6.4%)	3(3.4%)	47(2.4%)
	Strongly Disagree	0(0.0%)	6(5.5%)	4(4.6%)	28(1.4%)
	Total	627(100.0%)	651(100.0%)	666(100.0%)	1,944(100.0%)

* I have some trouble in studying if I don't know about computers

** I can live well in the future if I know about computers well

[2] In Table 15 and Table 16, the figures are the numbers of students responded.

5. EDUNET

The EDUNET is a national network developed solely for educational information service. The idea behind it is to build an open education system that works for anyone anytime anywhere. It was developed last year (1996) based on the analysis of foreign and domestic information systems (United States: Eduport, Canada: SchoolNet, England: SuperJanet, Superhighways for Education, Australia: EdNA, Taiwan: TANet, Singapore: SLP, German: School on the Network, China: CERNET).

Figure 1. EDUNET homepage

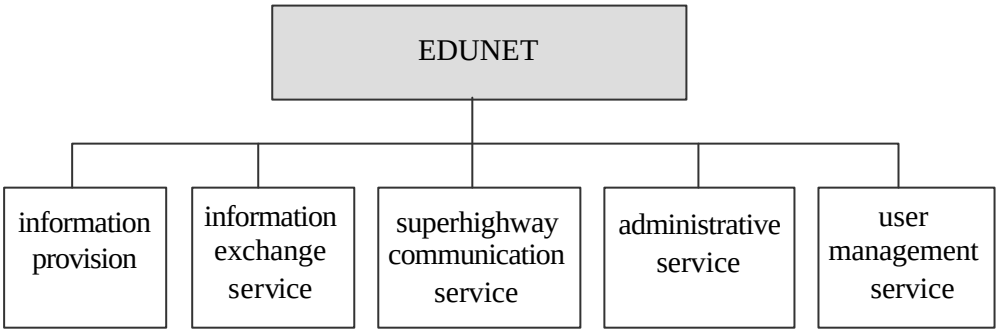
EDUNET went into service on September 11, 1996. EDUNET offers information through letter service and web service[3]. From September 11. 1996 to December 17, 1996, the total number of persons enrolled in EDUNET was about 41,100.

[3] To receive web service, one needs 486 CPU environment or higher, main memory capacity 8Mb or higher and Modem 14,400 or faster (http://edunet.nmc.nm.kr/ or http://128.134.77.133/).

To bring significant benefits to most people as far as education is concerned, the goals of EDUNET are the following:

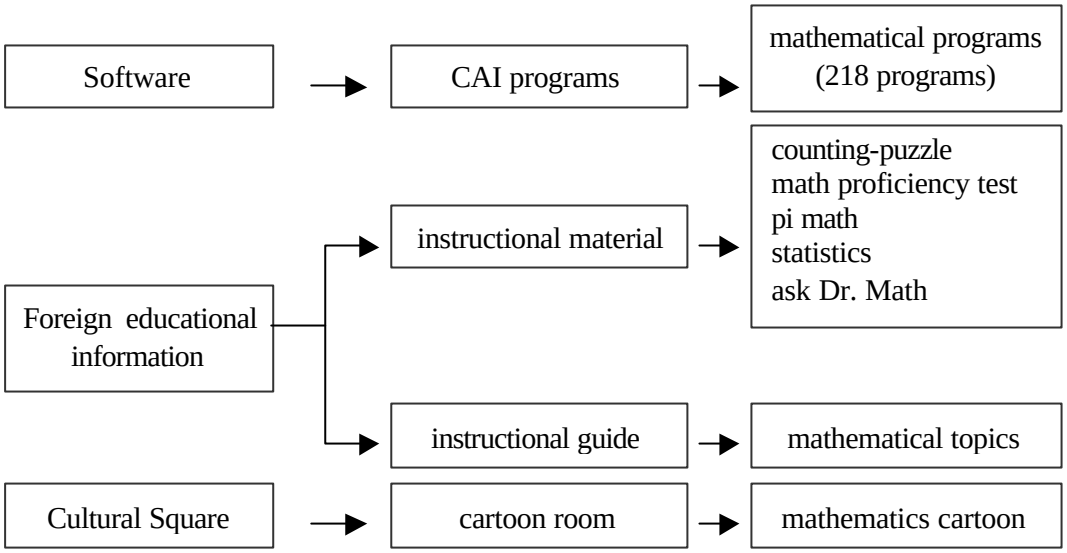
- To support teachers for their own instructional activities by allowing them to have easy access to a variety of instructional multimedia materials
- To support students for their own learning activities by offering individualized learning environments
- To support parents for educating their children and themselves by allowing them to have easy access to childcare information, on-line counseling, etc.
- To facilitate the growth of information-related industries in Korea
- To provide online educational opportunity for anyone anytime anywhere
- To enhance the information literacy levels of all citizens

The service consists of five categories:



- The information provision: it covers a broad range of education resources including research, audio/video resources, *edutainment*, and information about educational organization
- The information exchange service: it supports on-line school, electronic mail, Internet access, and interest groups
- The superhighway communication service: it supports distance education, home shop- ping, and home banking
- The administrative service: it provides statistical information on education, electronic official letters, policy information, and educational law
- The user management service: it covers user enrollment, eligibility management, user inspection, and user statistics

Information on mathematics through the information provision service in EDUNET are the followings:



In sum, EDUNET is expected to play an important role in education reform. At the same time, it still leaves a lot to be done, some of which is:

- Equitable access to qualify information at low-cost
- Richer contents reflecting cultural characteristics
- More involvement from private sectors, especially IT industry, publishing houses, and the press
- Links with other countries' educational networks
- Enhancement of information literacy levels of all citizens

6. Conclusions

According to the findings of MERC' report (1996), the government has made an effort toward the production of information industry manpower and the development of information technology literacy, through diverse school computer education plans such as expanding opportunities for computer education, providing hardware and software, and training teachers. However, there are still several things to be solved to practice computer education as directed under the 6th National Curriculum and to be prepared for the next national curriculum and computerization of school education. For this reason, the following recommendations were mades for more effective school computer education:

First of all, computer education should be set as all 'core course', at each school level.

In addition, the content needs to be weakened in the technical part and strengthened in the usage of authoring tools so that teachers and students can enhance their capabilities of computer use in their teaching and learning activities.

Second, most teachers seem to be positive about computer education. It was suggested that their positive attitude could be maintained and enhanced by providing them with benefits such as chief teacher status, special allowance, overseas in-service training, awards, etc. Also teacher training on computers seems to have resulted in teachers' positive attitudes toward the needs and capabilities for computer use. Long-term plans and to support teacher training should be prepared accordingly: For example, for improving the content, methodology, and appraisal system of pre-service teacher training, as well as in-service training, and preparing environments to be able to utilize their learning from the training.

Third, students are provided with aids for primarily the technical side of computers, however their capabilities to deal with ethical issues on computer were revealed to be low. It was suggested that opportunity for computer education should be increased and computer education curriculum reorganized so that computers become a learning aid. To do this, the financial support for software development, at government or company levels, are expected

(1) to develop educational software by diverse groups (program designers, subject teachers, subject educators, professional program developers, etc.),
(2) to enable access DB systems of previously developed educational software by networking,
(3) to hold contests such as educational software use and extracurricular activities, and
(4) to carry out the follows-up studies of the software developed.

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