Comparison between communication instruments for people with speech impediments and the efficiency of GUI environments

J-S. Jang Kookmin University, Seoul, South Korea

Abstract

Communication is a basic desire for all humankind, and it is believed that no special groups should suffer from a cultural lag in communication. This study focuses on special groups like people with an acoustic disturbance, and those with a normal sense of hearing who are able only to communicate through sign and finger languages. Among the major difficulties encountered during communication, there were individual differences in the understanding of texts and in the expressive method of gestures. To solve these basic problems, this study largely consisted of three stages. Firstly, the illustrations used in the sign and finger language textbooks of the Seon-hee Seoul National School for the Deaf (SNSD), as representative of schools for handicapped children in Korea, were redesigned into different illustrations that incorporated a high level of perceptiveness. Secondly, new sign language textbooks were made by studying and applying the effects of line width and length, as well as the number of pictures, on the degree of perceptiveness in communication for developed sign and finger languages. Thirdly, a language output mode was created to focus on programs with high generality, centering on developed textbooks and various prototypes of sign and finger languages. The difference in perception, among other things, will be measured in consideration of the speed of sign language, the shape of characters and the emotional aspect. This new textbook for the deaf is planned to be released all around the world, although the study of its effects may require the whole lifetime of the researcher. However, in consideration of those people who have difficulty in satisfying the basic interactive desire of humans and are socially isolated in their capacity for communication, this study is worthy of great expectations for the future.

Comparison between communication instruments for people with speech impediments and the efficiency of GUI environments

Aims and backgrounds of study

This study counts people with a speech impediment as its focus group, among other special groups, and is positioned to examine those who can only marginally share in various cultural benefits compared to people with a normal sense of hearing. Such hearing-impaired individuals have difficulties in communicating smoothly with those possessing a normal sense of hearing, as impacting a variety of cultural, educational and communicational avenues of expression due to the physical handicap. Besides which, communication between isolated groups is being developed from a different angle. It is natural that the dream of smooth communication is difficult to realize without first solving economic, cultural and social problems, as well as basic physical problems. Efforts to communicate via simple but various ways of language expression, however, were the motivating power behind this study. The results of interviews showed that such individuals could not communicate smoothly due to often heavy reliance upon a personal vernacular of familiar expressions and secret languages, though they might have received special education.

A quite interesting fact discovered during this study is that everyone tries to perceive things and convey a message - the basic desire of humans - by learning a language. The only difference between people with normal sense of hearing and those with an acoustic disturbance is that the former use a universal and typical way of expression called language (among various methods), while the latter utilize their own ways of communication via sign and finger languages.

One thing that drew my attention is that the deaf use a mobile phone, ironically, as a viable means of communication in Korea. They access it not on an audible level, but for the use of short message service (SMS) functions. Though there are some cases of the deaf communicating by use of a touch pad, as often shown in some soap operas, such a reality would be possible only for those cases who acquired their handicap later in life.

In an interview with students from the SNSD located in Chongro-gu, Seoul, conducted two summers ago, it was found that most students with a speech impediment have a complex disorder, as stemming from the major causes of cerebral infantile paralysis, brain dysfunction and learning disabilities. Thus the individual difference in gestures generates the appearance of dialects. With the encouragement of the principal, the focus of study over the last two years was on developing a systematic sign system.

This work was as hard as that experienced by King Sejong – the creator of the Korean alphabet. Though the research and development haven’t been finished yet, it was not until this study was facilitated that I realized such individuals would be much better able to constitute their own community if the work was conducted at an advanced and particular level. Simply put, they should be making textbooks with a distinct linguistic virtue relevant to their community, rather than merely accepting the simple level of expressing a language through illustrations.

After visiting SNSD, it was found that there was a great difference of communication ability from the educational aspect between those with a normal sense of hearing and the disabled. The deaf were communicating with each other in a variety of methods of expression. The miscommunication caused by these various modes of expression is likely to pose a great barrier in life between the disabled and other people. Communication among people with a normal sense of hearing has gone

smoothly even in different regions, as they learnt and practiced the relative definitions of expression, forms of expression, and correct textbook pronunciation in classes held in their mother tongue. As mentioned above, even people with a normal body and sense of hearing can effect various kinds of idiosyncratic changes in expression.

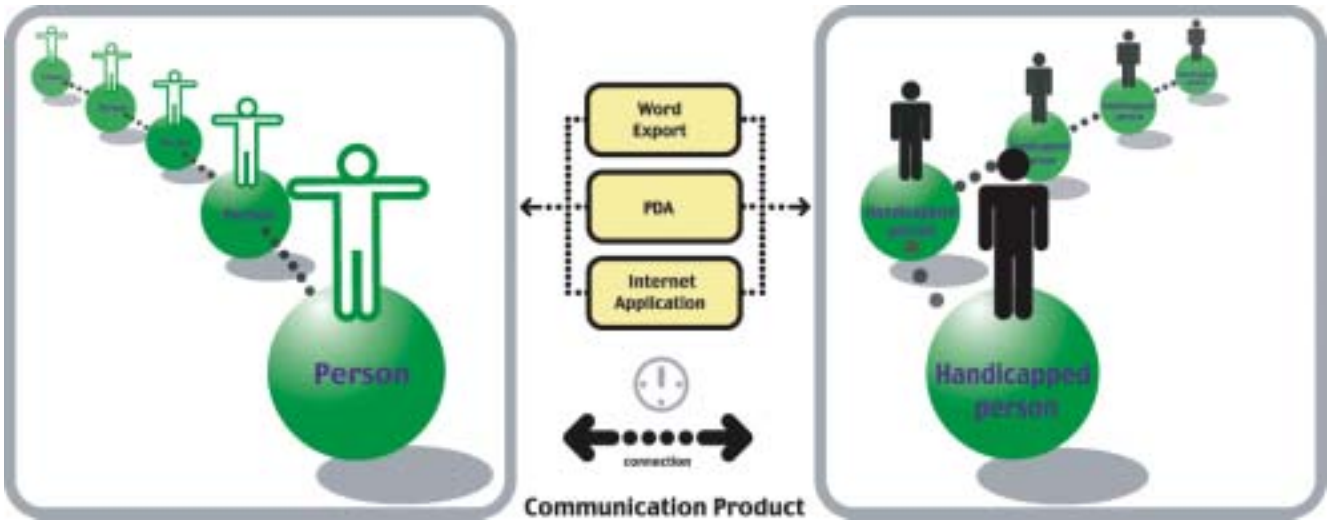

Fig 1: Community relationship between those with normal sense of hearing and the deaf

As mentioned above, the aims of this study are to search for new communication methods among those isolated by their physical handicaps, and to suggest a prototype of future design for a discursive framework. The intent is to establish a communication system, develop relevant instruments and implement a global communication system, on the road to constructing a communication system for people with a speech impediment and positioning the future models of design.

Changes in communication

Changes in communication, including the essential meaning, “to convey a message”, are in constant progress with the development of media. C. E. Shanon & W. Weaver, in an information and communication engineering module conceived about 40 years ago, said that: “The mathematically and precisely formulated model refers to a graphic formula for explaining human communication activities, starting from a technologically processed and physically prescribed signal set, and such keywords have been used as sender, receiver, code, sign, channel, redundancy, noise, encoding, and the like.”

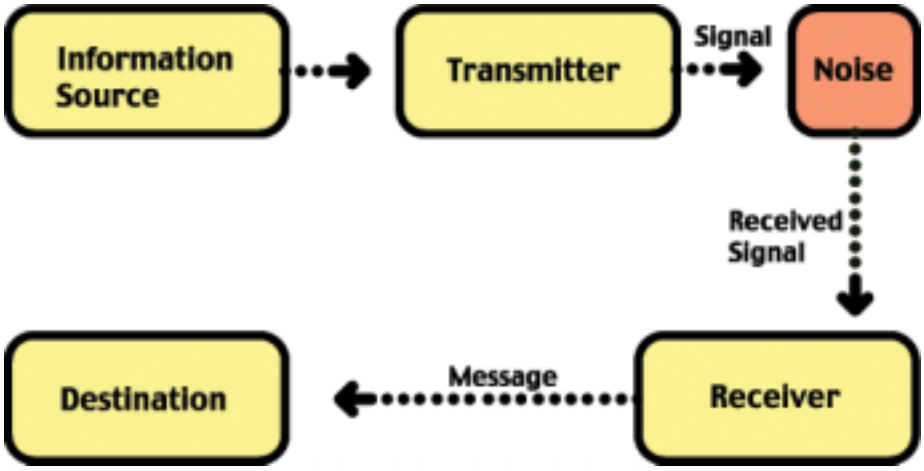

Fig 2: Communication model by Shanon & Weaver

In other words, it is a view which follows the model of behavioral psychology, the 'stimulus-response' mechanism that information is transmitted along a certain path from a sender to a receiver through the activity of communication. If the message of a sender is encoded and transmitted to a receiver, the sender and the receiver have the same information and as a result, an effect that evokes the same thoughts, behaviors and attitudes is expected.

Changes in the concepts of a sender and a receiver

The nature of the main body of communication has been changed. The active party that exercises controlling power over information access, communication and use in cyber space has undergone vast transformation. In other words, a receiver in the existing communication model has little control over transmitted information, except for a partial right to determine chosen access. As he or she is passive in the problem of when, why, from whom and what kind of information they will receive, there exists a deliberating organ who puts pre- and post-censorship on information content, time and intention in the name of public welfare.

In this structure, an information receiver in an era of multiplex communication is no more than an information consumer. Nevertheless the Internet created an active information user, not a passive information consumer. Users have full control over the content, time, intention and objects of information to transmit, as well as the ability to actively select the information to be consumed themselves. They are not receivers but information users, and act as creative main bodies in generating the contents and formats of media via active intervention and participation.

Internet communication service

Web users have come to enjoy much greater power than any other users of media, in that they can search for the services and information they want. Moreover, they are able to instantly give comments and opinions on the received information, or ask for the explanation and apology of a content provider. In this relationship, a user may have the experience of being transformed from a simple receiver to a provider by voluntarily modifying and editing information data on his or her own computer, as well as providing their own information on the Internet. As the concept of a receiver has been changed into that of a user in the S->M->C->R->I model of basic analysis for communication, and the user is able to simultaneously play the role of a sender, it is no longer possible to describe communication in cyber space with existing models. Interactive communication has been realized as escaping from the limits of one-way communication, and in the field of design, interactive expression that induces other people to respond by presenting an imperfect or ambiguous meaning rather than providing a perfect meaning has been increased.

Etymological meanings of sign language

Sign language goes back to the Age of Homo Sapiens in primitive times. In the era when human intelligence was unspecialized, man used 'gestures' as the primary medium of communication. On the other hand, modern humans surf the web among new currents of informatization. As shown above, the trends of communication change continuously. The new flow of informatization suggests both a wide range of thought and a chance to innovate knowledge.

Diverse communication environments caused changes within communication modes not only in general social environments, but also for people with a speech impediment. With these changes, a new educational medium of communication was expected for special groups who had difficulty in accessing various types of information. The first use of sign language in a school was in Lette, the school for the deaf in Paris, France (1760). In Korea, sign language first began to be used 80 years ago.

A person with an acoustic disturbance is someone who cannot hear sounds in a meaningful manner, and one who cannot grasp the meaning of sonic messages even when exposed to dissonant or high decibel sounds.

As the result of an interview, a congenial subject with impediments due to cerebral oxygen deficiency in the placenta or parental diseases (10%), and subjects with acquired handicaps due to diseases like the measles, meningitis, diphtheria, etc., as well as stemming from the side effects of streptomycin or an accident (90%) are considered to be suffering from the cause of an acoustic disturbance.

Problems in sign language

Sign language is a language invented by the deaf, so that the hearing-impaired may understand things and communicate. Still the method has a variety of problems as follows: It is a presentative means of expression. It is pictorial, and thus, cannot accurately express the nuances of emotion. Moreover, due to the limited expression of sign language the whole expressive nature of a language is not possible. As a single facial expression or gesture can constitute the subject of a dialogue, the accurate division of motions is the most important thing in communication.

Communication system design

This study largely consists of three stages. Firstly, the illustrations used in the sign language textbook for handicapped (acoustic disturbance) middle school students, as designed by the Ministry of Education, was reformatted into different illustrations featuring a high level of perceptiveness. Secondly, the efficiency of communication was inspected through comparison between existing and developed types. Thirdly, hardware instruments were developed with a design module to highlight a high degree of perceptiveness, as a software system was suggested. This software will be a key element in solving the problem of generality. In the future, the function of application would be included in this word processor with high generality, in order to develop a module for the disabled. There is intent to make a demonstrative inspection centering on this module pack, and to treat the disabled through new perceptive communication.

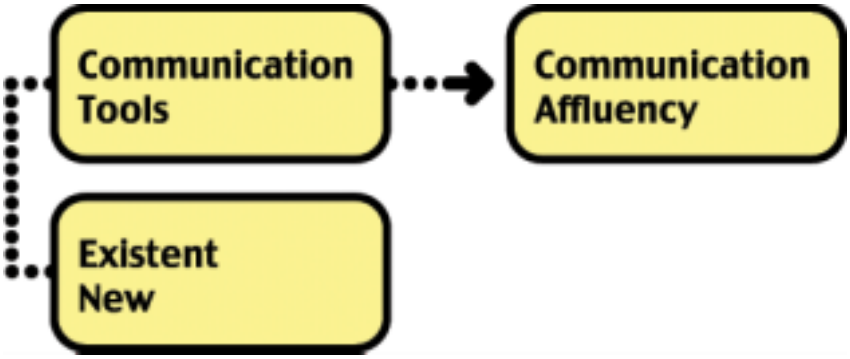

Fig 3: Conceptual framework

Finger language design

Arabic numerals were designed with illustrations in the sign language textbook for handicapped (acoustic disturbance) middle school students, as designed by the Ministry of Education. The illustrations are simplified examples. Currently, a design module to express a variety of languages is under development.

It is intended to estimate the perceptiveness of both those with a normal sense of hearing and the deaf, using line width and various speeds of animated images for sign language textbooks under

development. These will focus on the deaf, and are concerned with a high perceptiveness for the movement of things. This will be a key element in building a harmonious community between those with normal sense of hearing and the deaf.

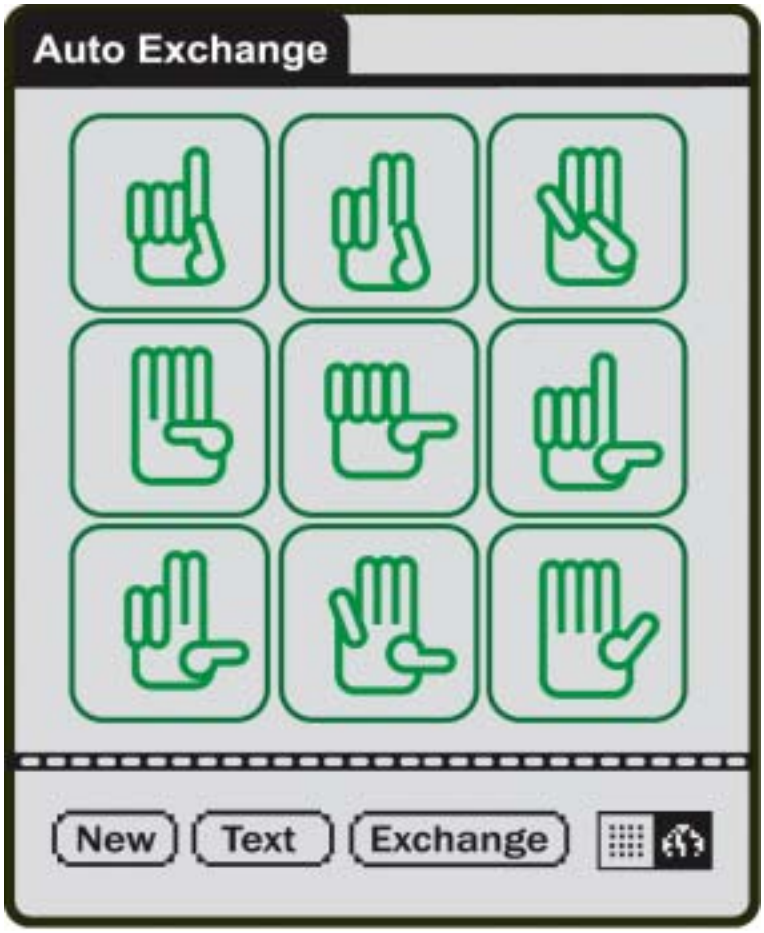

Fig 4: Finger language design

GUI environment of PDAs

Figure 4, 5, 6 is the GUI environment of PDAs that is gaining wide popularity. The displayed pictures are those activated through a sign language translation mode. There are finger language expressions geared to symbolize simple numbers, and a sign language display structured to add fresh fuel to the future development of a functional module. The size of display under development will be greater than previously existing models, and in the inner part of the terminal functions to give every kind of educational effect through various language expressions are under consideration.

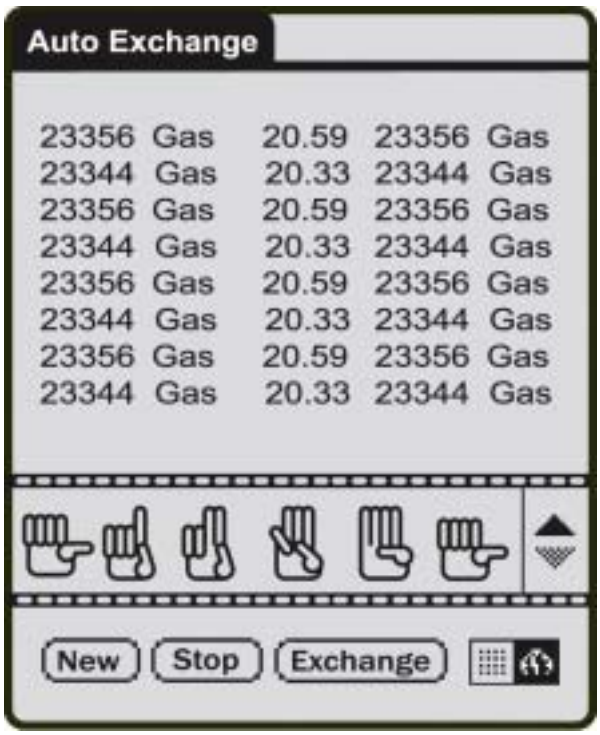

Fig 5: Auto exchange mode

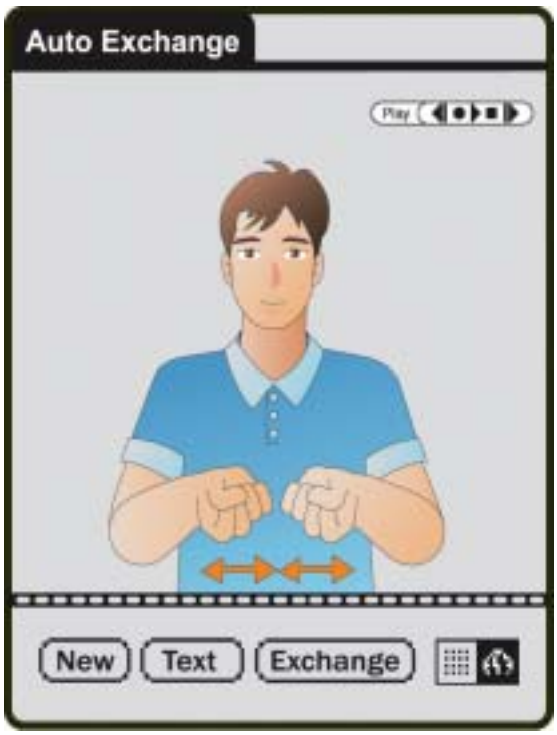

Fig 6: Sign language design

Interpretation of finger language test data

In this study, a test was conducted of SNSD teachers and students that focused on the finger language developed by prior research. The goal in the first sampling survey was to ascertain if communication is possible between those with a normal sense of hearing, and deaf subjects who are able to use finger language.

The field survey was conducted with students of the SNSD located in Chongro-gu, Seoul in April 23, 2002. The questionnaire was made up of 11 items, and all items except three involved the student making a guess at numbers with finger language. Knowing that there are many students with acquired cerebral infantile paralysis, the use of letters was avoided.

The intent was to measure the degrees of perceptiveness and errors within the developed finger language. Centering on this result, the visual definition of characters in prototypes for a secondary model of developed sign language is to be made.

		6~9	10	20	30	40	50	
Elementary Education	W	9	13					22
	M	6	11					17
Secondary Education	W		25	1				26
	M		24					24
Higher Education	W		20	5				25
	M		23	2				27
Teacher	W			2	7	18	3	30
	M				5	10	8	23
								194

Fig 7: Number of participants in the survey

For this survey, a total of 141 SNSD students were tested (including 39 from 9 elementary classes, 50 from 6 secondary and 52 from 8 higher classes), as well as a total of 53 faculty members among the staff of 97 (including the principal and 2 assistant principals, 65 teachers and 32 clerical staff members).

There were several test types of finger language under consideration. The A-type had three items: the first featured nine icons at nine by twelve millimeters in numerical order, the second was of nine icons without order, and the third has 18 icons in random order.

The B-type had five icons of 15mm wide and 20mm long, while the C-type had 18 icons in random order of 15mm wide and 18mm long. In the D-type, the largest test group to be completed involved 26 icons at six by eighteen millimeters. Two samples tested in the E-type for application to mobile communication environments had six icons each, for the writing of numbers 6mm wide and 8mm long. This test was carried out during 15 minutes per class, and the entered numbers were simply combined into a total.

		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Teacher	W	30	98.89	96.67	90.19	99.33	87.78	97.22	100	99.44	96.19
	M	23	100	84.54	96.38	96.52	98.07	95.89	97.83	97.83	95.88
		53	99.45	90.61	93.29	97.93	92.93	96.56	95.00	98.64	96.04
		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Elementary Education	W	22	89.39	81.31	75.50	85.45	73.98	81.81	82.57	82.57	81.57
	M	17	98.69	96.73	86.27	78.82	75.81	83.33	82.35	89.21	86.40
		39	94.4	89.2	80.89	82.14	74.9	82.57	82.46	85.89	83.99
		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Secondary Education	W	26	100	99.14	91	95.38	85.68	95.61	89.10	89.74	93.25
	M	24	100	99.07	89.81	85.00	85.65	94.33	86.11	85.42	90.62
		50	100	99.11	90.5	90.19	85.67	94.97	87.61	87.58	91.93
		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Higher Education	W	25	98.20	97.70	90.60	92	85.70	97.20	94	96	93.93
	M	27	96.70	96.70	94.24	97.78	89.74	98.97	92.59	92.59	94.91
		52	97.45	97.2	92.4	95	87.72	98.09	93.5	94.5	94.42

Fig 8: Simple totalization of teachers in elementary, secondary and higher education

Some quite interesting facts were found. Though it may be regarded as natural, students in higher education had the highest level of perceptiveness. This boils down to the fact that perceptiveness is

related to studies conducted up to the present. Girls in higher education were lower than boys at 93.93%, while girls in secondary education at 93.25% also showed a difference from boys. Boys in elementary education marked a high degree of 81.57%, and female teachers at 96.19% had a higher perceptiveness than male teachers.

There also existed a difference between the deaf at 90.12% and teachers at 96.04% in the classified total, which may be considered as due to differences in their relative positions as learners and teachers rather than stemming from their handicaps.

		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Elementary Education	W	22	89.39	81.31	75.50	85.45	73.98	81.81	82.57	82.57	81.57
	M	17	98.69	96.73	86.27	78.82	75.81	83.33	82.35	89.21	86.40
Secondary Education	W	26	100	99.14	91	95.38	85.68	95.61	89.10	89.74	93.25
	M	24	100	99.07	89.81	85.00	85.65	94.33	86.11	85.42	90.62
Higher Education	W	25	98.20	97.70	90.60	92	85.70	97.20	94	96	93.93
	M	27	96.70	96.70	94.24	97.78	89.74	98.97	92.59	92.59	94.91
		141	97.16	95.10	87.91	89.07	82.76	91.88	87.79	89.26	90.12

Fig 9: Totalization of the disabled students

In addition, seeing from the classified total among a series of eight items, simple arrangement questions showed the highest percentage at about 97.73%. Question 2 where the order was changed made a difference from Q1, and Q3 with a larger size showed a lower degree at 89.25%, while Q4 with many small lines marked a rather high percentage at 91.29%. The Q8 as applied to mobile communication showed quite a good effect at 91.60%.

		P	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	TOTAL
Elementary Education	W	22	89.39	81.31	75.50	85.45	73.98	81.81	82.57	82.57	81.57
	M	17	98.69	96.73	86.27	78.82	75.81	83.33	82.35	89.21	86.40
Secondary Education	W	26	100	99.14	91	95.38	85.68	95.61	89.10	89.74	93.25
	M	24	100	99.07	89.81	85.00	85.65	94.33	86.11	85.42	90.62
Higher Education	W	25	98.20	97.70	90.60	92	85.70	97.20	94	96	93.93
	M	27	96.70	96.70	94.24	97.78	89.74	98.97	92.59	92.59	94.91
Teacher	W	30	98.89	96.67	90.19	99.33	87.78	97.22	100	99.44	96.19
	M	23	100	84.54	96.38	96.52	98.07	95.89	97.83	97.83	95.88
		194	97.73	93.98	89.25	91.29	85.30	93.05	90.57	91.60	94.74

Fig 10: Classified total

Comprehensive analysis according to the classified total

In conclusion, this study identified - as expected - that a physical handicap doesn't always translate to a low intellectual ability. Though this kind of comprehensive analysis may be possible by allowing people with normal sense of hearing and the disabled to concurrently take an identical test at the same place, consideration should also be made in the future for those disabled who are isolated from other people in communication. Such subjects marked quite a high percentage in the total points, possibly resulting from the fact that questions which require the simple writing of numbers were included in the questionnaire, considering their brain damage and other physical handicaps. However, people with a normal sense of hearing were tested with the same questionnaire, and therefore it is thought that much consideration should be given from now on to the user interface design of a display screen.

The pictogram of finger language developed in this study, as centering on issues of comprehensive analysis, resulted in high perceptiveness in both those with a speech impediment and those with a

normal sense of hearing. Though there was a difference in relative intellectual ability, this problem is expected to be solved by the supply of various contents in future curriculums.

With the results of the new finger design, another interactive interface design should be applied to future prototypes for the experimental verification of new sign language designs. From now on, the interesting and exciting treatment of intellectual ability is to be expected via image-oriented characters and gestures extrapolating from the already developed precepts of existing sign language.

Conclusion

As a result of this study, it was found what effects the appearance of new sounds have on the communication course of images combined with a message, as centering on the comparative examination of communication courses for both people with a normal sense of hearing and a special group (the deaf).

A much more appealing alternative will be created if new instruments are introduced and more advanced application software is developed, by continuously observing and analyzing the variable factors of human psychology and solving certain problems. When the availability of this alternative is estimated by focusing on isolated groups, the desired sign and finger language systems will be completed as a result. After this, relative applications may be developed on the level of language treatment.

Several sign systems tested on the basis of this study proved that though some errors in communication between those with a normal sense of hearing and the deaf were displayed, the one group perceived signs based on their own intellectual abilities while the other has developed idiosyncratic methodologies based on individual organ sense adaptation. Therefore, it was found that a physical handicap is not always connected directly to low perceptiveness.

The expectation may be possible for a new concept of treatment with specialized instruments for the disabled. Furthermore, it may not be just a dream to envision the creation of contents predicated upon even minor treatment, as using yet to be developed various application software. As most disabled people are unwilling to learn sign and finger languages, the development and supply of interesting contents should be a prerequisite.

Based on the results of this study, the aims of future studies will be to build a harmonious community for both those with a normal sense of hearing and the deaf, by developing an advanced module and sign system and creating new instruments.

This study proved that there are few problems in communication between the disabled and those with a normal sense of hearing. It is expected that instruments for the disabled should be developed on a more practical level. Those interested in this study for the benefit of deaf individuals all around the world are always welcome to send an email to the researcher. <kmjanggo@kookmin.ac.kr>

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