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【短　報】

Development of a real-time information sharing system for sports environment research in special needs schools and its application to field research

KAKUTA Mitsugu[1)], NOMURA Ichiro[2)] and TAKEI Yoshinori[1)]

[1)]Faculty of Sport Science, Nippon Sport Science University
[2)]Faculty of Sport Management, Nippon Sport Science University

Development of a real-time information sharing system for sports environment research in special needs schools and its application to field research

KAKUTA Mitsugu, NOMURA Ichiro and TAKEI Yoshinori

Abstract: We have developed a real-time information sharing system to investigate the sport environment in special needs schools. A survey using the system shows that a wide range of departments, from primary schools to high schools, are taking various approaches towards physical education and physical education-like classes. The sharing of information through the nationwide information network system developed in this paper will help towards more tailored classes for pupils in schools and, in turn, be one of the means towards the spread and promotion of sport for the special needs.

要旨：特別支援学校のスポーツ環境を調査するリアルタイム情報共有システムを開発した。同システムを利用した調査から，小学校から高等学校まで幅広く，体育や体育的授業への取り組みが多様化していることが明らかとなった。本論文で構築した全国的な情報ネットワークシステムによる情報共有は，学校における生徒に一層より沿った授業に役立ち，ひいては障害者スポーツの普及と促進に向けた手段の１つとなり得る。

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Key words: Special needs schools, Sport environment, Information system, Implementation on the Internet
キーワード：特別支援学校，スポーツ環境調査，情報共有システム，インターネット実装

1. Introduction

Information and communication technology (ICT) is essential for anyone teaching learners with special educational needs. Needs maximise the value of technology as an important component of education (Florian 2004). For special needs teachers, the opportunity to learn about and utilise this technology is invaluable. Vigorous research is being carried out to remove information barriers so that everyone, regardless of physical disability, can use information and communication (Nict 2022). Practical research on the application of information and communication technologies and speech processing to solve the digital divide has also been carried out, mainly to support hearing impairment. Furthermore, research based on human communication is also being conducted (Takekawa 2018). In the future inclusive society to be realised by information infrastructures such as 5G, it is expected to ensure inclusive education for people with disabilities (Mext 2010). We have been investigating information processing to provide support in schools and teaching areas, with a particular focus on physical education in special needs schools (Kakuta 2019). One of the key points of this study is the information from the thoughts, movements, etc. by the pupils, as well as the teacher's

perspective. For the above analysis, we have proceeded in two steps: i) to understand the school situation, ii) to analyse information including the movements of students or pupils with special needs, and then we have also conducted surveys (Nomura 2017a, Nomura 2017b). This paper describes I) the information system developed for the questionnaire (Nomura 2019), which was conducted on a national scale in Japan via the internet. As for II), one of the new findings from the results of the questionnaire using the developed system is a discussion of physical education or physical education-like classes conducted in special needs schools from the perspective of para-sport.

2. Web system development and results for sports environment survey

This study developed a system based on the specifications described in Chapter 1 and implemented it on the Internet using the Google Forms web system. The top page of the developed web is shown in Fig. 1.

In 2019, a survey was conducted targeting disability types on that special needs education is based. This covers five disability types (Visual impairment, Hearing impairment, Intellectual disability, physical disability and sick or infirm disability). By displaying these species in a tree structure, a web-based system was constructed that can be answered from a smartphone. The survey obtained via the web and its timeline are shown in Tables 1 and 2, respectively.

One of the results of the data analysis obtained from this web is shown in Fig. 2. In this survey, there were 14 questions (with several more questions particular to each category category), and the results of Question 4 “Sports opportunities for children, excluding physical education classes, sports days and sports festivals; multiple answers possible” are shown in Fig. 2.

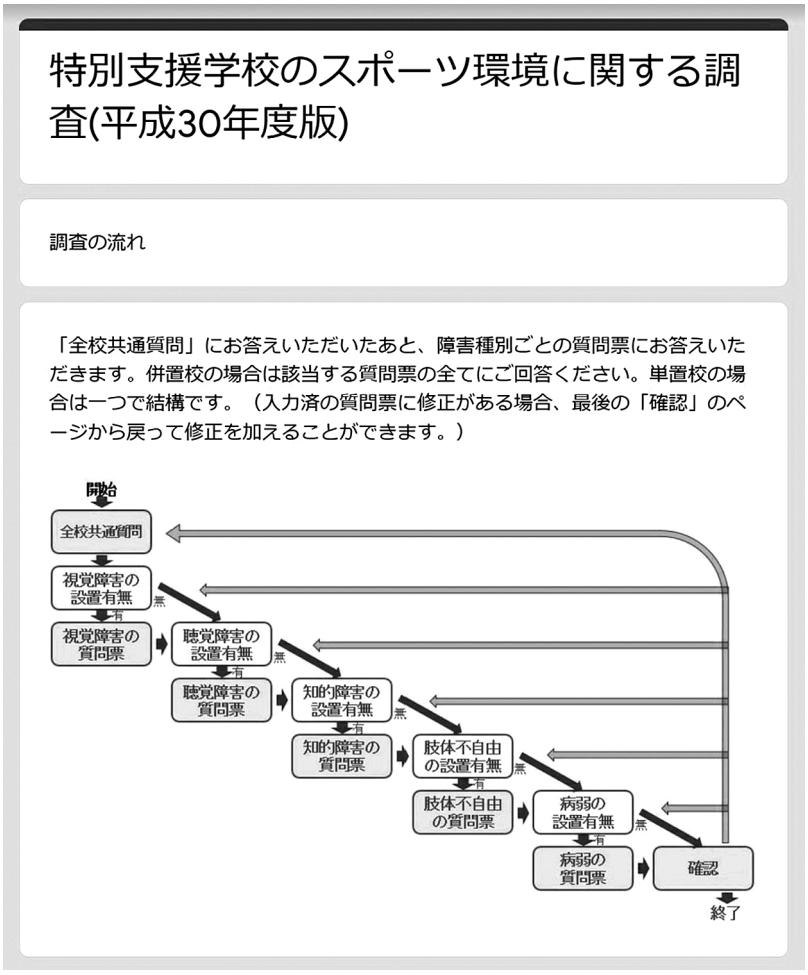

Fig. 1. Top page of the web for survey on the sport environment in special needs schools (FY 2018).

Table 1. Experimental Results from (Nomura 2019) [a: Type of school, b: Type of establishment, c: Establisher of school, d: Type of disability]

Main	510
Branch	46
Annex	34

(a)

Single	487
Co-located	103

(b)

National	22
State/Province	507
Ordinance	19
Municipalities	38
Private	4

(c)

Visual	43
Hearing	53
Intellectual	401
Physical	157
Sick or infirm	61

(d)

Table 2. Timeline of the development of the system for the questionnaire

Date (y/m/d)	Events
2018/12	Formulation of the technical specification of the system for web-inquiry
2019/1/9	Open of the e-mail contact for the users
2019/1/11	Questionnaire briefing session (in which it was explained that a pre-test precedes the questionnaire only for visual impairment)
2019/1/12-2019/1/23	Pre-test
2019/1/24-2019/2/2	Improvement of the specification of the web-inquiry based on the result of the pre-test
2019/2/3-2019/2/18	Test (and the performance of the questionnaire)

3. Discussions

3.1 Data processing

The responses shown in Fig. 2 are data that require relatively rapid disclosure. The developed system automatically processes these data and displays the results graphically in near real-time. One of the requirements for the development of this data-sharing system is that the results of the questionnaire are transmitted from the system to a data-sharing group consisting of several people in real time. As the data-sharing system depends on the internet, the public network everyone can access, consideration should be given to keep the three security ingredients referred to as *C.I.A. Confidentiality* is that only the intended parties (in this case, the developed system and the data-sharing group) can know the content of the data, *Integrity* is that the data are not changed after their issue (from the developed system) and *Authenticity* means that there is no impersonation. For this purpose, a cryptographic protocol is employed in our data-sharing system: A common secret key is shared among the data-sharing system and the members of the data-sharing group, in advance. When the data-sharing system issues a set of data, it encrypts the message using the secret key. Any potential eavesdropper cannot know the contents without the knowledge of the secret key, so the confidentiality is kept. And, if the ciphertext sent is corrupted in the way of the delivery, then the receiver can notice that by the fact that the decryption using the secret key fails. Thus, the integrity is kept. Moreover, when the decryption is succeeded, the receiver will have the confidence

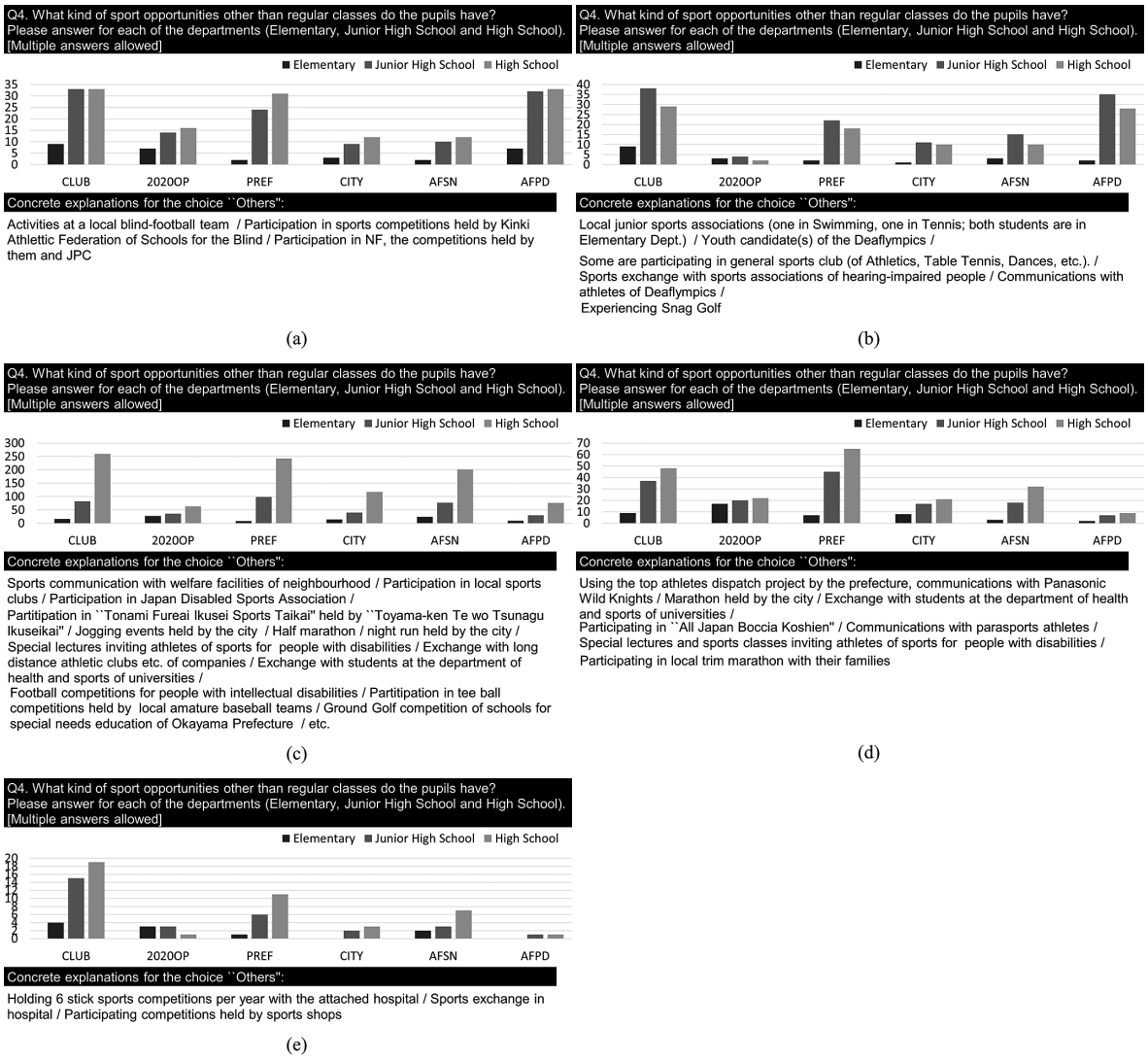

Fig. 2. Sport opportunities of pupils for special needs education [a:Visual impairment, b:Hearing impairment, c:Intellectual disability, d:Physical disability, e:Sick or infirm disability]. Labels under the graph are abbreviated as follows: CLUB = Club activities in the school, 2020OP = Education for Tokyo 2020 Olympic and Paralympic Games, PREF = Competitions for people with disabilities held by the prefecture, CITY = Competitions for people with disabilities held by the city, AFSN = Competitions for people with disabilities held by the athletics federation of special needs schools, AFPD = Competitions for people with disabilities held by an athletics federation etc. per disability (e.g. Athletic Federation of Schools for the Blind)

that the issuer is our data-sharing system who only can perform encryption using the same key. Authenticity is also kept. If a public-key cryptography is employed in place of the secret-key cryptography, the problem of "how to share the secret key among the system and the group" will be resolved. Also, the content identifier technology may be an alternative to keep the integrity.

3.2 Physical education or physical education-like classes in special needs schools

In Japan's Basic Plan for Sport (Mext 2017), three things are indicated: a) support for all special-needs schools to become local centres of disability sport, b) promotion of understanding among teachers at all school types, and c) enhancement of the sports environment for children with disabilities in schools. In addition, compulsory courses related to sports for the disabled in teacher training courses are being considered (Obuchi 2019). Table 3 shows one of the results obtained from the questionnaire "What the pupils do to familiarise themselves with exercise and sports outside of sports clubs and club activities, multiple answers allowed".

The highest response to the question "In physical education/physical-like education classes, we give individual guidance to ensure the appropriate amount

Table 3. Physical education content practiced to get close to sports outside of school

	Visual impairment						Hearing impairment						Intellectual disability						Physical disability						Sick or infirm disability					
	Elementary		Junior High School		High School		Elementary		Junior High School		High School		Elementary		Junior High School		High School		Elementary		Junior High School		High School		Elementary		Junior High School		High School	
Contents		%		%		%		%		%		%		%		%		%		%		%		%		%		%		%
Every day setting aside time other than physical education classes to exercise continuously	4	10.0	4	10.0	5	13.5	11	24.4	5	11.1	1	3.0	103	37.1	106	37.7	113	31.8	19	13.3	19	13.1	16	11.8	8	14.8	7	13.2	5	11.9
In some days of a week setting aside time other than physical education classes to exercise continuously	7	17.5	5	12.5	3	8.1	7	15.6	4	8.9	1	3.0	37	13.3	51	18.1	76	21.4	11	7.7	14	9.7	16	11.8	7	13.0	9	17.0	7	16.7
In physical education classes giving the pupils individual guidance to secure the amount of exercise that suits them	28	70.0	33	82.5	29	78.4	15	33.3	15	33.3	9	27.3	168	60.4	176	62.6	211	59.4	64	44.8	65	44.8	66	48.5	21	38.9	25	47.2	24	57.1
Keeping tabs on the amount of exercise the pupils do every day /every week	0	0.0	1	2.5	0	0.0	3	6.7	1	2.2	0	0.0	21	7.6	26	9.3	35	9.9	3	2.1	4	2.8	4	2.9	3	5.6	2	3.8	2	4.8
Consciously working on activities so that the pupils can continue to exercise and play sport after graduation	6	15.0	14	35.0	21	56.8	4	8.9	7	15.6	6	18.2	71	25.5	103	36.7	213	60.0	14	9.8	27	18.6	35	25.7	8	14.8	9	17.0	13	31.0
Cooperating with other organizations etc. so that the pupils can continue to exercise and play sport after graduation	4	10.0	9	22.5	15	40.5	3	6.7	2	4.4	4	12.1	14	5.0	32	11.4	87	24.5	3	2.1	11	7.6	19	14.0	0	0.0	0	0.0	2	4.8
Others	2	5.0	3	7.5	4	10.8	0	0.0	0	0.0	0	0.0	4	1.4	5	1.8	8	2.3	3	2.1	3	2.1	4	2.9	3	5.6	3	5.7	3	7.1
Total	40	—	40	—	37	—	45	—	45	—	33	—	278	—	281	—	355	—	143	—	145	—	136	—	54	—	53	—	42	—

of physical activity for each pupil" in Table 3 was 82% (visual impairment - secondary school; one of the yellow cells in the Table). On the other hand, the lowest 27.3% (hearing impaired—upper secondary; one blue in the Table). With regard to this question, the relatively high values when comparisons are made within the same disability category are evidence that the data show a high rate of sports practice. However, despite the above situation, there is not enough support for special needs education. One reason for this is that it is difficult to define the educational effects. One possibility to show this effect is to record it in a video system and analyse it from the perspective of brain science-based behaviour (Oberman 2007). The development of a video information system for this purpose is one of the issues to be addressed when providing educational support in future special needs schools.

4. Summary

This paper is a research study of support for special needs education based on information technology. The present study has described the development of a system for this purpose and new findings based on the data obtained from the system. Furthermore, the data obtained from all over Japan using the information system developed in this study was discussed in terms of the processing of the developed system and parasport. Future work is to develop the system based on standard guidelines (JIS 2010, JIS 2014, JIS 2016, JIS 2018) and conduct a questionnaire on special needs education in Japan and abroad. Finally, the authors also hope that this research will be a catalyst for innovation to both education and engineering in the field of special needs education.

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〈連絡先〉
著者名：武井由智
住　所：東京都世田谷区深沢 7-1-1
所　属：日本体育大学基礎教養系
E-mail アドレス：ytakei@nittai.ac.jp