WHAT DO PHYSICAL EDUCATION TEACHERS IN KOSEN TEACH IN HEALTH AND PHISICAL EDUCATION CLASSES? [A review of the relevance of the model core curriculum based on previous research]

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Abstract

In 2017, the National Institute of Technology established the Model Core Curriculum (MCC), providing specific goals for the knowledge and skills that students should acquire before graduation. In the original version, Health and Physical Education (P.E.) was categorized under "attitudes and orientation (human abilities)," considered cross-disciplinary competencies that engineers should have. However, the 2023 edition of the MCC does not specify the learning area for P.E. Minami et al. (2024) raised concerns that the P.E. curriculum at colleges of technology (KOSEN) may include content corresponding to the "core (basic skills)" outlined in the MCC.

This study aims to examine the nature of KOSEN P.E. education by reviewing previous research and discussing the potential positioning of P.E. in the MCC framework.

The keywords "KOSEN physical education" and "KOSEN health" were used to identify 57 articles related to P.E. classes at KOSEN in the CiNii research article database. Analysis showed that some articles addressed multiple learning areas, 60 classifications. The article content was analyzed, focusing on the learning areas of the MCC, especially the core (basic skills) to which they correspond.

Figure 1 illustrates the article distribution across MCC learning areas. The top three categories were as follows:

Engineering Ethics: Many P.E. classes emphasized safety management and injury prevention, likely contributing to students' understanding of ethical responsibilities in engineering.

Physics: Practical exercises in P.E. often require an understanding of mechanics and motion, thereby reinforcing foundational physics knowledge.

Globalization and Cross-Cultural Understanding: Some P.E. classes incorporated activities such as English-language instruction, physical disability simulations, and exposure to uncommon foreign sports. Instructors' flexibility in designing classes based on their areas of expertise facilitated this.

Several studies described interdisciplinary approaches in P.E. classes integrating content from physics experiments, biology, or even corporate understanding, reflecting an educational framework consistent with engineering training at KOSEN.

This study suggests that P.E. classes at KOSEN align not only with the development of students' attitudes and orientations (human abilities) but also with the core (basic skills) competencies defined by the MCC. Consequently, the MCC should be revised to reflect the multifaceted educational contributions of P.E. at KOSEN more accurately.

Keywords: *physics, project-based learning, creativity, engineer education,*

1. Introduction

The National Institute of Technology established the Model Core Curriculum (MCC) in 2017, which outlines the specific knowledge and skills students should acquire before graduation. This version categorized Health and Physical Education (P.E.) under "attitudes and orientation (human abilities)," a cross-disciplinary competency expected for engineers. However, the 2023 edition of the MCC does not indicate a learning area for P.E. Minami et al. (2024) questioned whether P.E. content at colleges of technology (KOSEN) aligns with the "core (basic skills)" section of the MCC.

In contrast, high schools, which enroll students of the same age group as those attending KOSEN, P.E. is officially recognized subjects in the National Course of Study. Its objective is to cultivate students' physical well-being not only through P.E. classes but also as a component of their overall educational experience

(Ministry of Education, Culture, Sports, Science and Technology, 2018). Furthermore, the Organization for Economic Co-operation and Development (OECD) introduced the OECD Learning Compass 2030 (OECD, 2019), outlining the future direction of education systems in member countries. This framework identifies physical and mental well-being as foundational to student learning. Most OECD member countries have incorporated P.E. or an equivalent subject into their national education systems.

Thus, P.E content is regarded as a fundamental component of general education, both domestically and internationally. However, neither the MCC nor the International Standard Accreditation System for National Colleges of Technology Education, launched in 2022 by the Japan Society of Engineering to ensure quality assurance under the KOSEN International Standard, refer to P.E. (Japan Society of Engineering, n.d.).

2. Purpose

The purpose of this study is to examine the characteristics of P.E. provided by P.E. departments at KOSEN, based on a review of previous research, to explore the role of P.E. in the MCC.

3. Methods

The keywords “KOSEN physical education” and “KOSEN health” were used to search CiNii Research, an academic article database, yielding 57 articles on P.E. classes at KOSEN. The article content was analyzed to determine the MCC learning areas to which they corresponded, with a particular focus on the “core (basic skills)” category. Some articles were relevant to multiple learning areas, resulting in 60 classifications in total. Figure 1 shows the distribution of articles across MCC learning areas.

4. Results and Discussion

4.1. Relevance of MCC to previous research

Figure 1 illustrates the learning areas of the MCC addressed in the selected papers. Owing to space limitations, this study focused on the top three areas. Physics is considered a foundational subject for understanding physical movements and exercises involving equipment in practical P.E. classes (e.g., Matsui & Azuma, 2019). Globalization and multicultural understanding are reflected in the ability of P.E. classes at KOSEN to be conducted in English (e.g., Nigo & Ito, 2023), include simulated experiences of people with disabilities (Ichiya et al., 2018), and feature uncommon foreign sports (Watanabe & Sato, 1998). Instructors have flexibility in designing courses based on their areas of expertise, enabling these practices.

4.2. P.E. Leading to Engineer Education

The details of P.E. classes reported in previous studies reveal that some were designed to contribute directly to engineering education at KOSEN. These include classes integrating P.E. content with subjects such as physics, physics experiments, biology, and corporate understanding of safety management and injury prevention (Hirama, 2010).

Sakata et al. (2012) described a hurdle-running class utilizing a video delay display device at their affiliated KOSEN. Students practiced 20-meter hurdle runs and used delayed video playback to review their form immediately after each attempt. The time and motion of their hurdle runs were recorded before and after practice and compared from a biomechanical perspective. The results showed that students’ hurdle times and motion improved, which was attributed to the use of the device. Furthermore, students’ written reflections indicated that analyzing their hurdling form helped them overcome athletic challenges. This class not only demonstrated the effectiveness of using a video delay system for efficient skill acquisition but also highlighted the educational value of developing students’ problem-solving skills by analyzing physical performance from a biomechanical perspective, reflecting a promising outcome for engineering education.

Kato and Tamura (2018) conducted a project-based learning (PBL) exercise class in collaboration with industry and academia. This was part of the “Advanced Health Science” course at Toyota KOSEN and aimed to enrich liberal arts education for engineering students through practical P.E. content. Students worked in groups on a defined task and presented their findings to a company representative in the final week. The presentations included ideas and suggestions for future applications based on the effects observed in an exercise intervention conducted during the course. This format of group work, result presentation, and peer voting resembles the hackathons often held in the IT field. Furthermore, a questionnaire survey indicated that this hands-on project deepened students’ interest in health science and encouraged active engagement. Including a presentation to an external party (i.e., the company representative) added a sense of realism that appeared to boost student motivation. Moreover, over 80% of the students expressed a desire to continue these types of learning experiences, suggesting that PBL-style classes incorporating practical P.E. elements may effectively enrich liberal arts education for engineering students.

Shibayama (2020) designed a P.E. course titled “Creative Sports Practicum” that aimed to foster creativity among fifth-year students at the KOSEN where he teaches and reported the practical outcomes. Students were encouraged to take an active role in planning and managing P.E. sessions based on three core elements of creativity: novelty, ingenuity, and problem-solving (Figure 2). The effectiveness of the class was evaluated using a creativity assessment administered during the first and final sessions, and the students provided written reflections after each class to document changes in their perceptions of their creativity. The results demonstrated that students improved the novelty and ingenuity of their ideas, their ability to solve problems during class, and their overall understanding of the concept of creativity.

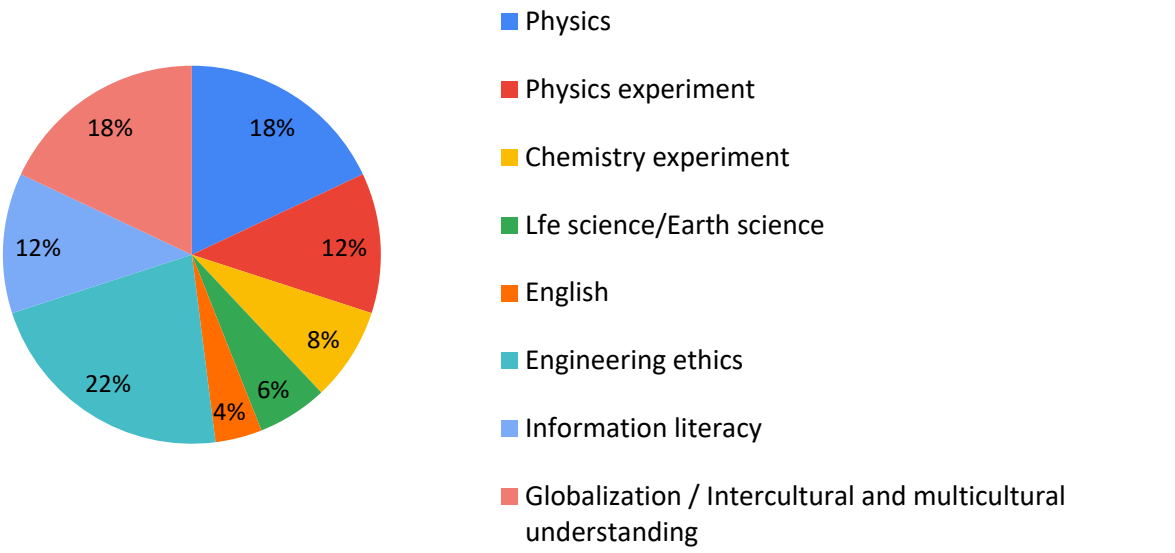

Fig.1 The relationship between P.E. course content and the learning areas of the MCC based on previous research.

Fig.2 The conception and implementation of a snowball fight in a creative sports practicum.

In addition to aligning with the findings from previous research on creativity education in P.E., the study highlighted the importance of incorporating activities tailored to KOSEN students' unique characteristics, such as the design and use of original instructional tools. Thus, the study made a valuable contribution by suggesting that creativity, a foundational element of KOSEN education, can be effectively nurtured through P.E.

4.3. Position of P.E. in the MCC

A review of previous studies on KOSEN P.E. classes indicates that P.E. may contribute to learning outcomes such as "independence," "self-management skills," "responsibility," "teamwork skills," "leadership," and "ethics," as defined by the MCC (National Institute of Technology, 2017), as well as areas such as "chemistry experiments," "life science," "earth science," "English," and "globalization, cross-cultural and multicultural understanding." Furthermore, some instructors are actively integrating P.E. content classes into engineering education. Given these findings, the absence of P.E. in the current MCC for KOSEN overlooks the educational and research contributions that P.E. instructors have made. Therefore, based on the above, as a proposal to position P.E. in the MCC core (basic skills), "II-E Life Science, Earth Science" in "II Natural Science" could be changed to "II-E Life Science, Earth Science, Health Science (Table 1)." Thus, in the future, it will be necessary to consider clarifying the unique learning content of P.E. at KOSEN in the MCC.

Ohara et al. (2024) surveyed students at one institution to examine the significance of P.E. classes at KOSEN. Based on the results, they highlighted the importance of redefining the role of P.E. in each academic year and intentionally modifying the form and content of classes. These suggestions consider the unique educational challenges at KOSEN, such as the prevalence of dormitory life and wedge-shaped curricula, when designing an MCC for P.E As a reference from other fields, the MCC for medical education explicitly includes "sports medicine," with examples of classes designed to enable students to assess an individual's physical functioning and life activities and plan exercise support based on the person's values and behavioral science (Ministry of Education, Culture, Sports, Science and Technology, 2017). This demonstrates the feasibility of integrating sports and professional education within an

MCC. Similarly, clarifying how P.E. can be linked to engineering education in the MCC for KOSEN should be possible. However, in applying this system, it is necessary for each school to devise ways to utilize the expertise of health and physical education teachers and to collaborate with teachers of specialized departments, etc.

Finally, KOSEN institutions claim to cultivate "doctors of society" who contribute to building a sound and sustainable future (Organization of National Colleges of Technology, online). Foundational knowledge of physical and mental health is indispensable

Table.1 Abilities KOSEN students should acquire

【In current, model of MCC (core)】

Basic skills that all engineers should have
Ⅰ Mathematics
Ⅱ Natural science Ⅱ-A Physics Ⅱ-B Physics experiments Ⅱ-C Chemistry Ⅱ-D Chemistry experiments Ⅱ-E Life science, Earth science
Ⅲ Humanities/Social Sciences Ⅲ-A Japanese Ⅲ-B English Ⅲ-C Social
Ⅳ Engineering basics Ⅳ-A Engineering experiment technology Ⅳ-B Engineer ethics Ⅳ-C Information Literacy Ⅳ-E Globalization and mulitcultural understanding

【Revised model of MCC (Core) based on the results of this study】

Basic skills that all engineers should have
Ⅰ Mathematics
Ⅱ Natural science Ⅱ-A Physics Ⅱ-B Physics experiments Ⅱ-C Chemistry Ⅱ-D Chemistry experiments Ⅱ-E Life science, Earth science, **Health science**
Ⅲ Humanities/Social Sciences Ⅲ-A Japanese Ⅲ-B English Ⅲ-C Social
Ⅳ Engineering basics Ⅳ-A Engineering experiment technology Ⅳ-B Engineer ethics Ⅳ-C Information Literacy Ⅳ-E Globalization and mulitcultural understanding

Position of P.E.

(The National Institute of Technology, 2023, p.13; modified by the authors)

to the basic qualities and competencies required by such individuals. Building on this foundation, students should be equipped to make healthy and meaningful contributions to society.

Conclusion

P.E. classes at KOSEN encompass the learning area of core (basic) skills and students' attitudes and orientation (human abilities). Given the potential for P.E. to contribute to engineering education, the MCC should be promptly revised to reflect these aspects.

Furthermore, although this study is based on previous research, more extensive and detailed investigations, such as surveys and interviews with P.E. instructors at KOSEN, are necessary to gain a deeper understanding.

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