**下列為如何表達您對編修後之文字的疑問範例**

**基本原則：**

1. 內文請保持論文內容
2. 以黃色底色先標示有疑問或意見處
3. 請採取[新增註解](https://support.office.com/zh-tw/article/%E6%8F%92%E5%85%A5%E6%88%96%E5%88%AA%E9%99%A4%E8%A8%BB%E8%A7%A3-8d3f868a-867e-4df2-8c68-bf96671641e2)方式說明疑問
4. 請以英文明確表達您的疑問或意見

**Using robots in play-based learning for engineering education of exceptional students**

*<insert authors>*

ABSTRACT

Thomas Edison and Albert Einstein were undoubtedly two of the greatest and most influential scientists of all time, and yet history shows that both were regarded as slow learners by their teachers. . Today, they would likely be diagnosed as having special educational needs, due to their short span of concentration and lack of emotional control. However, exceptional students such as Edison and Einstein may also have advantageous characteristics such as greater insight and sensitivity toward their surroundings or a more aggressive attitude and stronger performance in learning. Such characteristics are likewise beneficial for engineers. As exceptional students do not necessarily respond optimally to traditional teaching methods, alternatives need to be sought. Learning through play could be an ideal approach for educating students with special needs. During play, students tend to concentrate better and be more self-disciplined as play is naturally interesting. Exceptional students potentially learn more from playing than from conventional teaching methods due to their keen powers of observation.

Robots have been effective when used to support play-based teaching activities, especially in primary education. Here, we introduce robots as a teaching-aid for exceptional students. We developed a new curriculum for engineering education for both mainstream and exceptional students. This curriculum includes eight units or instructional sessions, which range in content from the basic principles of mechanics to advanced control of intelligent robots. The curriculum emphasizes problem solving, engineering design, teamwork and self-discipline. The LEGO NXT educational module is used to support versatile play-based teaching activities. The intelligence of the robots is programmed with the Microsoft Robotics Developers’ Studio which provides an easy-to-learn visual programming language allowing for enhanced playability.

To validate the developed curriculum, we organized an eight-week summer camp called *Edison Robotic Camp*. Of the 18 students who attended, two had been diagnosed with ADHD, three with autism, one with a learning disability and the remaining 13 students had not been diagnosed with a learning disorder. We divided students into 6 groups with each group having at most one student with special needs, and the other members randomly assigned. The teaching and observation team included an instructor, three teaching assistants and a counseling psychologist. The observation team participated in the teaching activities so that they could closely observe and record the behaviors of the students. Students were evaluated in three areas: learning performance, concentration and interaction with partners. The psychologist interviewed parents, the instructor, and teaching assistants before, during and after the camp.

It was found that the learning performances were similar for the exceptional students and the normal students. The levels of concentration for the exceptional students were acceptable for the classroom activities, and the special needs students were able to complete most of the tasks. The only observed problems for the exceptional students were communication and interaction with team partners. Parents, the instructor and teaching assistants did however report noticeable improvements in the manners of the exceptional students. With such positive results, we see potential for learning-through-play to be broadly applied in engineering education for exceptional students.

**KEYWORDS**

##### Special-needs students, robotics, learning performance, LEGO, engineering education, learning-through-play

**下列為錯誤範例，將導致誤解或不能被理解**

1. 無標示疑問處
2. 問題不明確
3. 中文說明問題

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