

## Article

# Research on Involvement of STEAM Education Curriculum in Social Participation: Case Study of Changzhao Station in Dachang Lane

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**Abstract:** With the aging of the population structure, all age groups have long-term care needs, and currently, and the elderly are still the majority. The extended medical and non-medical service needs are implemented at home, community, nursing home, or long-term care center locations. Most seniors want to live in a familiar and customary community environment. Low willingness for outside agency-style services has resulted in unaffordable stress for many families, which becomes a social problem that cannot be ignored. Therefore, the Taiwanese government promoted the long-term care 2.0 policy in 2017 with A, B, and C grading schemes. This research is carried out to improve the utilization rate of different types of services and implement local long-term care needs, taking the C-level lane Changzhao Station as an example. Not all were elderly or those with limited mobility. Some have a certain level of education or social experience and were also enthusiastic and curious about learning new things. To emphasize the importance of social participation and health promotion for the elderly, it is necessary to break through the traditional teaching model of the past. This research adopts the STEAM cross-field grandparents co-learning teaching model with three different levels of robotic implementation activities. Through the assembly and testing process, the elderly practice brain and hands-on exercises. Such preventive courses effectively help the elderly delay the deterioration of disability. There are increased intergenerational topics to enhance the social participation and sense of achievement of the elderly. Summarizing the research results, the STEAM bionic robot practice course has a high degree of learning satisfaction. Effectively applied to the alleys and long-term photos of Changzhao 2.0, the learning model enhances the social participation of the elderly and the effect of delaying disability.

**Keywords:** PBL problem/project-oriented learning, STEAM education, Robotic implementation, Hutong long-term care station, Grandparent co-learning, Social engagement, Delayed disability

## 1. Introduction

With the advancement of medical technology, the average human life expectancy continues to increase, and the population is gradually aging. The National Development Commission of Taiwan pointed out that the proportion of the elderly population reached 7.1%, and Taiwan has become an aging society in 1993. In 2018, the proportion of the elderly population increased to 14.56%. Taiwan has officially turned into an aging society, and it is estimated that the proportion of the elderly population will rise to 21.6% in 2027, entering a super-aged society (National Development Commission, 2022). The increase in the elderly population increased the demand for elderly institutional services in Taiwan, too. Comparing the available quantities, there will be insufficient demand in the next few years. According to the Ministry of Health and Welfare's long-term follow-up report on middle-aged and elderly people, the desire for living arrangements has not changed much in a long time, and the elderly who expect to live with their children are still the majority. The proportion of the elderly living in care institutions has been low as it was only 1.5%. Most elderlies still hope to live in a familiar and habitual community environment and maintain an independent and comfortable life (Hsu and Chen, 2019). The above results indirectly highlight the importance of community care. To develop a comprehensive social care service, there is a need to combine the strength of local organizations. Only in this way, we have effectively achieved the ideal local aging community for the elderly (Theobald and Luppi, 2018; Feng et al., 2020).

In recent years, the long-term care policy has mostly aimed at local aging in Taiwan as stated in the long-term care 2.0 policy by the Ministry of Health and Welfare in 2017. An emphasis was placed on establishing community-based long-term care systems. A community-integrated care model is set up in each township such as a community-integrated service center (level A), complex service center (level B), and long-term care station in alleys (level C). The community-based integrated care model provides convenient care services for the elderly. The policy encourages all grass-roots units and medical institutions to jointly invest in the community to add long-term care stations. There provided the elderly with communal meal service, caring visits or telephone consultations, referral services, health promotion, social participation, prevention, and delay of disability services. In addition to exerting the function of breathing, it also achieves the benefits of social participation, thereby improving the quality of life of the elderly.

### *1.1. Social Participation*

A long-term follow-up was reported on middle-aged and elderly people by the Taiwan Ministry of Health and Welfare (2020). By gender and age group, the proportion of females living alone increased with age, while males have a "U"-shaped trend in living alone. Martin (2015) pointed out that social participation was an important support for the interpersonal relationship of the elderly, including educational participation, volunteer participation, political participation, organizational participation, religious participation, and participation in various other social activities. Retirement life for the elderly was similar to that of the unemployed. When there broke away from habitual time planning, there was uncertainty in the arrangement of daily life. Thus, it is necessary to find alternative new time plans in later life. Social participation might be a possible path for the elderly to escape unplanned life. Relevant research results show that the lower degree of social participation is related to the decline of physical strength, the loss of physical function and self-care ability, and the self-feeling burden of disease that accompanied aging, so the elderly gradually choose static types of activities.

Illness self-perception refers to the subjective view of the patient's self. The perception affects the patient's willingness to go out, accept the current physical condition, leave the family for group life, and care about other people's opinions. It also influences making friends with normal people at ease and the future with hope and confidence. Age-induced disability is more likely to completely deprive an older person of the possibility of activity. The fewer opportunities for social contact, the more rapid the decline of the elderly's health functions. The results of the research also revealed that the higher degree of social participation of the elderly significantly lowers the feeling of functional deprivation. If the elderly maintain a certain degree of social participation, the degree of psychological depression reduces.

Volunteers conduct service-type social participation. The elderly needs to find their positions in old age and obtain self-worth affirmation and quality of life (Chen and Wu, 2009; Hsieh, 2019; Chuang et al., 2021). Bethell et al. (2021) pointed out the three aspects of the active aging policy framework. In addition to health and safety, the importance of social participation is also emphasized. Although there has a lot of free time to plan, they gradually rely on others' help due to aging, declining health, and declining self-care ability. Thus, opportunities for social contact and self-identification reduce. The research of Redondo-Samah et al. (2020) stated that social participation, social support, and active aging have significant correlation effects. Among them, the sub-dimensions of social support, social support, and self-esteem support are the best predictors of social participation. Emotional social support through family and friends is needed for the elderly to enhance their sense of social value. Leisure participation is the best predictor of active aging. More social support and interaction allow the effect of being active and happy.

### *1.2. Delayed Disability*

The 2020 Healthy Nation White Paper of Taiwan's Ministry of Health and Welfare stated that policy planning in the elderly population is required for the prevention of disability of the elderly due to aging. The sub-goals listed five health indicators: frailty and disability prevention, falls and fracture prevention, depression and suicide prevention, rehabilitation and post-stroke disability prevention, and the signing and implementation of advance medical directives, including physical, psychological, social, environmental, and spiritual aspects. Among them, the prevention and treatment of frailty and disability in the elderly is the priority monitoring indicator, and there are nine response strategies: (1) planning strategies for the prevention and treatment of frailty in the elderly, and integrating the resources of various ministries through legislation, (2) developing a screening form for frailty in the elderly, and promote self-screening, health screening for the elderly, and community screening, (3) combining the county and city government or community groups to guide the elderly in exercise and dietary health promotion methods through community volunteers, student associations, student services, and care for the vulnerable elderly in the community, (4) strengthening the care of the elderly by primary family physicians, (5) strengthening comprehensive geriatric assessment by geriatric specialists, (6) strengthening the frailty detection and care of the elderly and their family members/caregivers, (7) implementing community health center elderly care team services, (8) establishing elderly care systems at all levels, related to quality control, and financial planning, and (9) strengthening the research on frailty in the elderly and finding out the risk factors of frailty and effective intervention methods.

The main purpose is to implement a care plan for preventing and delaying disability, including covering muscle strength exercises, life function reconstruction training, social participation, and providing care programs to move toward the goal of successful aging (Chen, 2018). In addition, five physiological signs are used as indicators of individual frailty, including unintentional weight loss, perceived exhaustion, weakness (hand grip strength), slow walking speed, and low physical activity. Scholars believed that hand grip strength has the highest correlation with frailty and that hand grip strength and upper limb muscular endurance are important influencing factors of daily activities. Because hand grip strength is easy to measure and predict, it is often used to characterize strength in older adults (Fried et al., 2001). Mirakhorlo et al. (2018) and Tan et al. (2021) conducted a study of muscle strength training activities for elderly people in long-term care institutions. The results confirmed that through long-term muscle strength training, there were significant differences in muscle strength, grip strength, and daily living (ADL, Activity of daily living) of the elderly. A context that supports learners' creative thinking fosters creativity (Baker and El-Saidy, 2020). Lin et al. (2022) adopted a more community-centered service model, and the delayed disability module course used traditional Chinese medicine to prevent and delay disability care. For community elders over 65 years old, a 12-week TCM awareness seminar and Baduanjin exercise were arranged. For two-hour practice per week, there was improved health cognition and healthy physical state of the elderly in TCM. The results showed that preventing and delaying the disability module improved the physical fitness and memory ability of the elderly. In addition to preventing physical aging and implementing active aging goals, it was suitable for community activity promotion.

### 1.3. PBL and STEAM Education

Villar et al. (2020) pointed out that various types of learning activities help the elderly age actively. More than 95% of seniors believed that they could benefit from the learning process. It is necessary to break through the traditional teaching mode for the importance of social participation and health promotion for the elderly. The research was different from that of the previous traditional text-based learning mode, mainly using Problem and Project-Based Learning for Science, Technology, Engineering, Art, and Mathematics (STEAM) multi-disciplinary teaching mode. An interdisciplinary approach was used to teaching mathematics. Based on mathematical logic, the connotation of science and technology were learned through hands-on construction projects and the presentation of artistic aesthetics. In an interdisciplinary teaching framework, the focus was on specific topics rather than being confined to a single subject. Practice thinking through different perspectives and cross-border communication skills are cultivated under diversified development. There is learning more about solving real-world problems with hands-on learning.

Interesting and challenging situations are necessary to ignite learning curiosity and a desire to explore. Through the hands-on process, the idea is put into practice to build a prototype and test whether the plan solves the demand. From teaching activities combined with life situations and practical hands-on practice, the elderly can learn the ability and attitude to face challenges. In the process of building solutions by hand, they are encouraged to learn the educational philosophy. Mistakes and failures are inevitable but precious processes. Failures are reflected to find the cause of the problem and correct the practice accordingly. Then, trial and error are mandatory for finding a way to succeed. In addition to improving patience and frustration tolerance in learning, independent thinking needs to be practiced. Therefore, it is important to let the elderly learn to assemble the robot. The independent learning process also enhances the problem-solving creativity of the elderly (Chung et al., 2018; Kim and Kim, 2020;). In STEAM education, learners are encouraged to discover how to create new things, rediscover new perspectives, and combine them in unconventional ways. By thinking independently outside of the routine, the elderly can complete the process independently. Then, a sense of self-worth and improved physical and mental health can be obtained (Jamil et al., 2018).

## 2. Materials and Methods

The objective of the research was the elderly of Changzhao Station in Dachang Lane. To effectively carry out the STEAM robot education course, innovative problem and project-based learning were adopted with STEAM's multi-disciplinary teaching mode. The purpose was to enhance the social participation of the elderly in the robotic assembly, learning the connotation of science, technology, and mathematical logic. The participants practiced different perspectives and thinking and developed communication and interaction skills. Preliminary research was conducted in the Senior Citizen University of the National Kaohsiung University of Science and Technology. The STEAM paper robot practical course was originally designed for children to play with. The assembly process inspires students' thinking and creative ability. Thus, the course was taught to retired seniors at the Alley Changzhao Station. By using their hands and brains, the elderly became interested in lifelong learning and grasping the pulse of technological development. Through the assembly and testing process, the elderly practiced mutual aid and cooperative learning. The preventive courses effectively helped the elderly delay the deterioration of disability. The robots assembled by the elderly were given to their grandchildren. The social participation and sense of achievement of the elderly improved and the goal of preventing and delaying disability was achieved. After the event, the satisfaction questionnaire was distributed for effectiveness analysis (Figure 1).



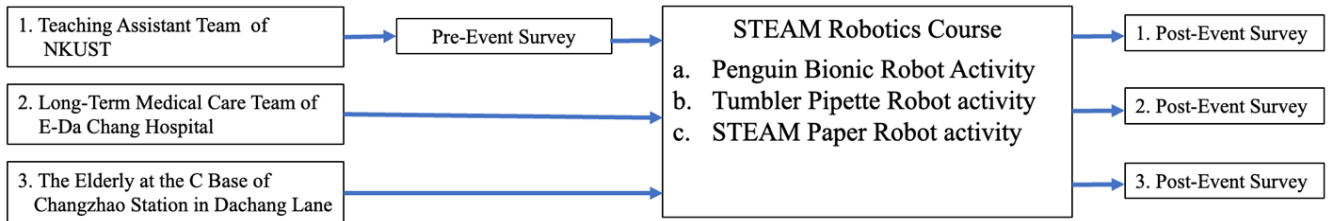


Figure 1. Research process architecture.

In terms of curriculum design, there was a difference from the general classroom with a single-teacher teaching method. The course required teaching assistants and medical care teams to assist in the activities. This cross-age teaching assistant team included graduate students, college students, five junior college students, and the professional long-term medical care team of E-Da Chang Hospital. Three STEAM bionic robot practical courses were designed for the elderly at the C base of Changzhao Station in Dachang Lane. The courses included the beginner course on penguin bionic robot assembly, the intermediate course on tumbler straw robot assembly, and the advanced course on STEAM paper robot assembly (Figure 2).



Figure 2. PBL and STEAM Robotics Implementation Course Execution Content: (a) Penguin Bionic Robot Activity. (b) Tumbler pipette robot activity. (c) STEAM paper robot activity. (d) Group photo of grandson, teaching assistant, and medical team. (e) Penguin bionic robot and tumbler straw robot work. (f) STEAM paper robot work.

From a step-by-step hands-on course, the participants assembled robots in each course. In addition to lifelong learning opportunities, the development trend of emerging technologies was shown, and the digital gap between grandparents and grandchildren narrowed. With the help of teaching assistants and medical care teams, the elderly' rich experience is passed on to the next generation. The participants helped children learn thinking and problem-solving skills. At the same time, the children fed ideas back to the elderly, which enhanced the interaction between different generations. In addition to enhancing the relationship, the sense of social participation, achievement, and delaying disability of the elderly in the community were also observed. During the activity, it was found that the elderly were willing to discuss and communicate with the children and the teaching assistant to gain self-identity. At the same time, a bridge was built for the interaction between the young and the elderly. For the cross-age teaching assistant team, to obtain teaching experience inheritance. To learn how to combine long-term care medical applications with an engineering major. They contribute to future classroom learning at the school.

### 3. Results

#### 3.1. Feedback from Long-term Care Station Elders

The long-term care station was in the arrangement of the course content and the teaching effect of the teachers. The medical and nursing team of the long-term care station were in Dachang Lane. Before the event, there was a briefing session to explain what each course was about, how difficult it was, and how to proceed. After the event, the satisfaction rate with the arrangement of the course content was above 90%. The participant thought that the course objectives were clear, the content was rich, and the satisfaction rate was 94.55%. The elderly showed a high interest in the novel and creative course content. The elderly commented that they hoped to carry out more related activities and courses in the future. The overall average satisfaction of the elderly with the curriculum arrangement was 92.73% (Table 1). In addition, the participants in the activity believed that the lecturer's teaching attitude was serious and responsible, the oral expression ability was good, and the elderly interacted harmoniously, which was helpful to understand the teaching content. The overall average satisfaction of the elderly with teachers' teaching was 93.64% (Table 2).

**Table 1.** Satisfaction survey of seniors who attended the course.

Course Content	Satisfaction Percentage	Overall Satisfaction Average
The lessons are clear and informative.	94.55%	
The course content is clear and easy to understand.	92.73%	92.73%
Schedule of course hours.	90.91%	
Overall planning of the course.	92.73%	

**Table 2.** Elderly satisfaction survey on teacher teaching.

Teacher's Teaching Content	Satisfaction Percentage	Overall Satisfaction Average
The teaching attitude is serious and responsible.	96.36%	
Oral expression ability.	92.73%	93.64%
Interaction with students.	92.73%	
Comprehension of the teaching content.	92.73%	

#### 3.2. Teaching Assistant Team Feedback

For how to conduct the course, consultation channels, rights, and obligations, the overall average satisfaction rate was 94.67% (Table 3). In general, the participants hoped to improve their ability to solve practical problems, workplace work attitude, future career planning, and meet the needs of the future industry. They were willing to encourage their younger siblings to participate in this type of community activities, and the overall average satisfaction rate was 94.44% (Table 4).

**Table 3.** Satisfaction survey of teaching assistant teams before participating in community service activities.

<b>Before the Event</b>	<b>Satisfaction Percentage</b>	<b>Overall Satisfaction Average</b>
A pre-service orientation or clarification would be helpful to me.	93.33%	
Before the service, the school provides me with complete service information or consultation channel.	92.00%	
I have understood the rights and obligations related to the service before the service.	97.33%	94.67%
I learned about the service content before taking an off-campus community service course.	96.00%	

**Table 4.** Satisfaction survey of teaching assistant team after participating in community service activities.

<b>After the Event</b>	<b>Satisfaction Percentage</b>	<b>Overall Satisfaction Average</b>
After the service, I feel that I have improved my ability to solve practical problems.	96.00%	
This service helps me to understand the work attitude in the workplace.	94.67%	
After this service experience, I will encourage my younger brothers and sisters to participate in off-campus community service.	94.67%	94.44%
I think the schedule and type of community service arranged by the school are in line with the needs of the industry.	92.00%	
I think community service classes help me find a job after graduation.	93.33%	
I think the overall planning and implementation of the school's service courses can meet the improvement of future employability.	96.00%	

### 3.3. Feedback of Changzhao Station

The medical and nursing team of the Long-term Care Station in Dachang Lane and the student teaching assistant team participated in the course activity. They had a good attitude and a high attendance rate and communicated harmoniously with the elderly. However, there was still room for improvement in the professional ability and familiarity of the teaching assistant team with the content, and the overall average satisfaction rate was 98.00% (Table 5). The co-learning curriculum planning with grandchildren improved the working ability of the student teaching assistant team. The course schedule and type arrangement, visit counseling mechanism, and administrative supporting measures met the needs of long-term care activities, and the overall satisfaction rate was 99.00% (Table 6).

**Table 5.** Survey on Student Service Satisfaction of Lane Changzhao Station.

<b>Alley Changzhao Station is satisfied with student services</b>	<b>Satisfaction Percentage</b>	<b>Overall Satisfaction Average</b>
How satisfied are students with their learning attitudes?	100%	
Satisfaction with students' attendance?	100%	
How satisfied are the students with their professional abilities?	90%	98.00%
How satisfied are students with interpersonal communication and teamwork spirit?	100%	
Satisfaction with student performance?	100%	

**Table 6.** Satisfaction survey on curriculum planning of Changzhaolong Station.

Alley Changzhao Station is satisfied with the curriculum planning	Satisfaction Percentage	Overall Satisfaction Average
Curriculum planning and training help to improve students' workplace ability.	100%	
The schedule and types of service courses can be arranged to meet the needs of long-term care stations in alleys.	100%	
The visit and counseling mechanism can meet the needs of long-term care stations in alleys.	95%	99.00%
Administrative supporting measures can meet the needs of long-term care stations in alleys.	100%	
The overall planning and execution of the course can meet the needs of long-term care stations in alleys.	100%	

## 5. Conclusions

To the elderly in the long-term care stations, a STEAM teaching course for robot assembly at different difficulty levels was taught. The participants were encouraged to bring their grandchildren to complete it together. Children were interested in assembling robots and asked the elderly to take them to class early in the morning. The course effectively improved the fluency and execution effectiveness of the course and communication between grandparents and grandchildren. However, in terms of the course schedule, several participants thought that the class time should be earlier. Delaying class time affected the elderly who took public transportation as they needed to prepare for lunch or pick up grandchildren after school time. Although many seniors were unfamiliar with robots, this hands-on process increased creativity and imagination and stimulated the potential of the elderly. All hoped to take more similar learning courses with their grandchildren in the future. The learning model of the STEAM bionic robot of grandfather-grandchildren was effectively applied to the Changzhao station of Changzhao 2.0. The course enhanced the social participation of the elderly and the effect of delaying disability. For the student teaching assistant team, as several members had not done preliminary robot assembly training, there was still room for improvement in professionalism. In the future, if a similar course is arranged, the robot assembly manual of the course needs to be provided before the activity for the teaching assistant team to be familiar with the assembly procedure. This increases the familiarity of the operation when assisting in teaching, assists the elderly more quickly, and makes the course more efficient. The course adopted the innovative teaching mode of PBL and STEAM, which was different from traditional teaching. The medical team at the Lane Long Care Station observed that the elderly were willing to try to find a solution to the problem by themselves. During the process, the elderly also was willing to discuss and exchange opinions with the teaching assistant team. In addition to gaining self-recognition from the course of the activity, a bridge of interaction and communication was built between the young and the elderly, and the generation gap was filled. The elderly's satisfaction with the overall curriculum design and service was 93.1%. The teaching satisfaction for teachers and the teaching assistant team was 94.5%. The overall satisfaction of the medical team for the three STEAM bionic robot practical courses was 96.0%. The innovative teaching model enhanced the social participation of the elderly and delayed the effect of disability.

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