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# Collaboration and cooperation systems to prevent suicide among children in Japan: effective use of the Observe–Orient–Decide–Act loop

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Suicide among school-age children is a serious issue in Japan, exacerbated by the coronavirus disease 2019 pandemic. Collaboration and cooperation between schools—where children spend much of their time—and medical/welfare services are indispensable. However, teachers are overworked, and intensified stress levels have led to high absenteeism. We propose the effective use of the Observe–Orient–Decide–Act (OODA) loop for timely collaboration and cooperation between schools and medical institutions to manage high-risk children as a measure to prevent suicide. We administered questionnaires to 205 teachers who worked with children, nurses, welfare professionals, and school counsellors in schools and related facilities; 171 respondents with valid responses were included. We examined their self-rated health, attitudes towards the OODA loop, levels of depressive symptoms, satisfaction/dissatisfaction with the current status of collaboration and cooperation, and reasons for this. When we compared those satisfied/dissatisfied with the current status of collaboration and cooperation, we found no significant differences in the level of depressive symptoms, but the self-rated health of the latter was poorer. We identified three factors in the attitude survey on the OODA loop—flexible and independent situational assessment, group monitoring and sharing, and self-monitoring—and those who were dissatisfied showed lower scores for all items. We classified the reasons into three categories—details of collaboration and cooperation, methods of collaboration and cooperation, and organisations for collaboration and cooperation—revealing marked differences. The level of satisfaction with the current status of collaboration and cooperation was correlated with the level of mental health. Satisfied participants were more positive about adopting OODA perspectives. Raising awareness of the OODA concept among teaching personnel, creating an organisational structure, establishing systems for appropriate and organic collaboration between schools and medical/welfare institutions, and reviews by external institutions are necessary to effectively use the OODA loop.

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## Introduction

In Japan, suicide among young people is a serious issue. Japan is the only developed and G7 country where suicide is the leading cause of death among young people aged 15–34 and 10–29, respectively (Ministry of Health, Labour and Welfare 2021a, 2021b). The impact of coronavirus disease 2019 (COVID-19) on child growth, development, life, and learning is marked. Many surveys report diverse and serious influences of COVID-19 on children—*anxiety and fear of the disease; depression; loneliness; isolation in life with an uncertain future, where they are forced to exercise self-control; disturbances in sleep, food, and their daily routine; difficulties with attending school; a decline in mental health; self-injurious behaviour; and an increase in the number of suicides* (Ministry of Health, Labour and Welfare 2023; National Center for Child Health and Development 2022; Takahashi and Shibata 2020; Yamano 2021). Globally, COVID-19 has disrupted school-based services that are indispensable for child development and care, such as mental health and psychosocial support, and caused stress and anxiety owing to ‘loss of interaction with peers’ and ‘disruption of daily life’ worldwide (United Nations Children’s Fund 2021).

For children in these circumstances, there is a need to establish counselling systems and inspect and review them in collaboration with schools (Kitagawa and Sasaki 2021, Ministry of Education, Culture, Sports, Science and Technology 2021a, 2021b, 2022, Sakanaka 2016, Takahashi 2021). Timely cooperation between schools and medical institutions, focusing on the association between self-rated health and the risk of depression, is essential for managing high-risk children who complain of poor health conditions (Okada et al. 2022).

The idea that interprofessional collaboration between schools and communities should be further promoted is established, but the problem of stress among teachers is escalating. Notably, the need for interprofessional collaboration in schools stems from various issues, including excessively increased teaching duties and consequent long working hours. The number of teachers on leave owing to mental disorders associated with extremely busy schedules remains high (Ministry of Education, Culture, Sports, Science and Technology 2021c), and this impacts children, leading to increasingly complex problems. International comparisons show that Japanese teachers work the longest hours, with work outside the classroom taking up most of their time (Teaching and Learning International Survey 2018). Then, the question arises as to how teachers themselves perceive their health and whether there are any problems with the way interprofessional collaboration between schools and communities is conducted.

With regard to collaborative cooperation, in the field of social work, a strong professional identity and confidence in one’s own expertise are necessary when working with people from other professions, and the structure of interdisciplinary collaboration holds significance (Bronstein 2003). Studies on education and multidisciplinary collaboration have focused on interprofessional healthcare (D’Amour et al. 2005), interprofessional education with multidisciplinary team members to train medical students (Bridges et al. 2011), interprofessional partnership education (IPE) (Reeves et al. 2018), and the importance of intervention and evaluation to improve collaboration and patient care in IPE (Reeves et al. 2018). In addition, a systematic review of 64 studies over the past two decades shows that each professional with a different job title actively contributes to interprofessional collaboration (Schot et al. 2020). This emphasises that collaborative cooperation requires different efforts by teams and networks, as well as by healthcare subsectors, and involves bridging gaps, negotiating overlaps, and creating space; thus, it is important to examine the day-to-day practices of professionals (Schot et al. 2020). In addition, the collaboration inherent in healthcare

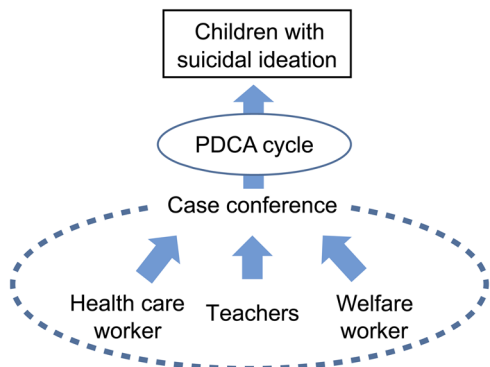
services points to the need to encourage the individual and collective efforts of frontline managers and promote change and support creativity in working communities composed of various professions (Folkman et al. 2019).

In Japan, some researchers stress the importance of learning about and developing awareness of professional collaboration (Saito and Asakura 2020), while others emphasise the need to differentiate between education and medical care, avoid making unilateral demands, create face-to-face relationships, and develop interprofessional collaboration systems between schools and medical institutions (Ichikawa et al. 2022). A survey of 16 cases—to investigate methods for collaboration between teachers and various other professionals—revealed that collaboration involves various forms of supplemental support, such as consultation, and that details vary markedly according to the situation of each school-age child. The survey also identified various challenges—*collaborating consciously from the perspective of ‘team school’, having a wide view to understand subsequent situations, and enabling teachers to judge and determine the form of collaboration* (Mimura et al. 2019). Care is being provided at schools, to an extent, by school counsellors and school social workers. However, this mostly targets children already diagnosed with developmental disorders, and support for undiagnosed and high-risk children is still insufficient.

The Ministry of Education, Culture, Sports, Science, and Technology (2016) highlighted the importance of applying the Plan–Do–Check–Act (PDCA) cycle to individual education support plans. We are also currently using the PDCA cycle for interprofessional collaboration. However, it is not effective in all cases and has a problematic structure.

The idea of PDCA—developed by Shewhart—was first introduced to Japan by Deming, generalised as a quality control cycle, and then developed as a management cycle (Ohnishi and Fukumoto 2016). However, the emphasis on the *Plan* phase means that the PDCA cycle is weak when managing unexpected situations. Its essence lies in the faithful execution and evaluation of each plan, with feedback for new plans (Ohnishi and Fukumoto 2016). However, in an era of uncertain and rapid changes, such as the one we are currently experiencing, the PDCA cycle is not always sufficient. In the PDCA cycle, as plans formulated in the past are implemented and evaluated, it is difficult to flexibly incorporate changes in the external environment and adequately respond to unexpected situations. For example, in case studies, there are many situational assessment-related tasks in the *Plan* phase, which should also be addressed in the following phases. This makes it difficult to effectively implement the PDCA cycle (Murooka et al. 2017). When performing patient safety-related duties, the *Plan* phase remains a set of vague qualitative goals without concrete quantitative numerical targets, and progress is not made (Fukami and Nagao 2022). Limitations of the PDCA cycle are also noted in emergencies with no temporal leeway, where it is difficult to take actions after formulating a plan and to flexibly manage situations or changes not anticipated in the planning stage (Fukuda 2010, Ohnishi and Fukumoto 2016).

Thus, in the current system, schools collaborate with medical and welfare institutions, hold case conferences, and manage each case mostly using the PDCA cycle, but the *Plan* phase requires time and labour. As efforts are made to follow plans, responses are often slow—the *Check* phase takes substantial time, and the *Act* phase is not carried out. As a result, teachers’ appropriate response to children is interrupted; their working hours increase; and they become exhausted and increasingly stressed, developing psychological problems. Figure 1 outlines this as a conceptual diagram.



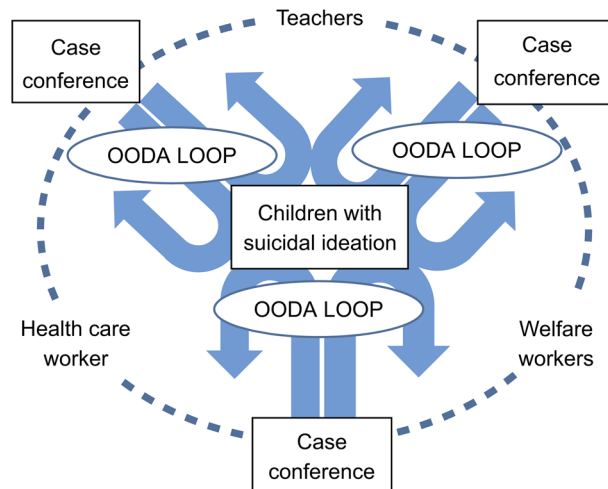
**Fig. 1 Conventional PDCA-based collaborative cooperation system.** The Plan-Do-Check-Act (PDCA) cycle currently in place is illustrated in the following diagram: the Plan tends to be time-consuming and laborious; the focus is on following the Plan, so actions are often taken later; the Check phase is time-consuming, and the Act phase is not carried out. In emergencies, it is difficult to respond flexibly to situations (changes) that were not foreseen at the Plan stage because there is no time to spare.

In contrast, the Observe-Orient-Decide-Act (OODA) loop, developed by military strategist and United States Air Force Colonel John Boyd, is a rapid decision-making model that emphasises mobility (Coram 2002). It is possible to manage emergencies by quickly repeating this loop. The OODA loop has garnered attention as a model for decision-making in emergencies, which creates the strongest culture to achieve objectives in each organisation based on the principles for resolving various problems (Richards translated by Harada 2019). For these steps, a loop structure that constantly feeds back to *Observe* is essential, and the speed at which the loop turns smoothly is key (Kitamura and Kitamura 2009, Nakamura 2006). The necessity for this process is explained from the perspective of risk management, crisis management, and efficiency in building next-generation organisations (Harada 2020, Irie 2019). In disaster management, decision-making systems based on Boyd’s OODA loop have already succeeded in resolving problems related to unpredictable and dynamically changing environments (Dag et al. 2008).

In clinical practice, the OODA loop is considered an attractive paradigm accepted by both nursing and medical members of collaborative teams, as iterations to it help make important changes to treatment plans, providing an effective method for the convergence of healthcare research and clinical practice (Villars et al. 2008). Advanced OODA loops have also been proposed for the selection of new ideas for decision-making and the application of future-oriented thinking to development (Vettorello et al. 2019). In addition, effective decision-making is essential for all medical activities, and the integrated results of the healthcare decision-making process provide the necessary knowledge elements to maximise patient benefit (Wickramasinghe et al. 2009). The OODA loop concept, therefore, is currently being successfully used in the field of medicine. Furthermore, the OODA loop has been reported to be a solid option for decision-making in cybersecurity and incident handling support (Husáka et al. 2022).

As demonstrated above, while the OODA loop, with all its possibilities, has been utilised in strategy, disaster relations, and healthcare, to the authors’ knowledge, there have been no studies incorporating it into collaboration in other professions, particularly in the field of education.

When focusing on interprofessional collaboration for education and medical care/welfare—where each collaborator is required to make rapid and flexible decisions in constantly changing situations—the OODA loop may apply. The fastest and



**Fig. 2 Proposed OODA-based collaborative working system.** The proposed Observe→ Orient→ Decide→ Act→ (OODA) loop is a rapid decision-making model for military operations that emphasises mobility, as it addresses the emergency situations faced by quickly repeating the process. As each person involved is responsible and can make course corrections as the situation changes, it is expected to foster spontaneity on the part of the supporters.

optimal responses are urgently needed to manage high-risk children as a measure to prevent suicide. Considering this, we focused on the OODA loop as a dynamic collaboration system that can be applied to personal information security incidents, where flexible decision-making and rapid execution are top-priority. By effectively using the OODA loop, it is possible to promote each supporter’s autonomy, as each participant can take responsibility and make course corrections according to changes in the situation under a cooperative system. Figure 2 illustrates this.

In the current PDCA cycle, the process involves a meeting among multiple professionals for high-risk children, where they set goals, determine the course of action, and implement plans. However, as per the OODA loop, each of the multiple professionals can individually respond to high-risk children promptly and appropriately, with collaboration and decision-making as necessary. This will alleviate teacher fatigue and improve their health. Currently, however, there is no intention of introducing the OODA loop for collaboration and cooperation between schools and various professionals in medical/welfare institutions. In addition, teachers are becoming increasingly overworked and exhausted.

Therefore, the purpose of this study is to clarify the current status as a basis for incorporating the OODA loop into systems for collaboration and cooperation between education, medical care, and welfare services for the first time. Specifically, we examined teachers and other educational personnel to clarify their: (1) awareness of health and mental health status; (2) attitudes towards the OODA loop as a basis for its use; and (3) attitudes towards the current status of collaboration and cooperation.

**Methods**

**Participants.** To determine the sample size, we assumed that differences would be evident in the pre-analysis. We calculated the effect size, not known from previous studies, as a moderate 0.5. The significance level was 0.5%. We calculated the power of the test as 0.8 as recommended in Cohen’s d, and used a sample size of 128 people as the minimum line. We targeted 205 teachers,

who worked with many children; nurses; welfare professionals; and school counsellors from schools and related facilities in five cities with populations ranging between 30,000 and 100,000. These were representative of Japan in terms of size, gender ratio, and academic performance. Of the 205 respondents, the 171 (82 men, 88 women and one other) with valid and complete responses were included in the analysis (83.4% valid response rate).

**Study period and procedure.** We conducted an anonymous, self-administered questionnaire survey from October 2021 to October 2022. We visited teachers, welfare professionals, and school counsellors at their schools and at training seminars or case study meetings to distribute an explanatory document outlining the study and to provide an oral explanation.

### Study items

**Self-rated health.** Self-rated health is a subjective assessment of one's health status that helps evaluate aspects of overall health status that cannot be measured with objective indicators, such as mortality and prevalence. A survey of 3128 people in 1971 showed a correlation between self-rated health and actual poor health. As mortality is considered the most objective measure of general health status, the strong association between self-rated health and mortality has been used as evidence of the validity of the use of self-rated health (Mossey and Shapiro 1982). In addition, based on 204 and 409 re-interviews from the 1991 Swedish Level of Living Survey and the 1989 Survey of Living Conditions, respectively, confirmed as reliable (Lundberg and Manderbacka 1996), and a survey of 56,427 representative individuals aged 50 or older in 16 European countries, people with multiple comorbidities are more likely to experience self-perceived health deterioration, depression, and reduced functional capacity (Palladino et al. 2016). The current situation is that 26,566 people in European Union countries are being surveyed through periodic online health surveys that include asking them about how they rate their health (Hone et al. 2016).

In previous studies on lifestyle, quality of life, and somatic symptoms—especially involving older adults—the survival rate was higher among those with higher self-rated health scores, showing that self-rated health also influences life expectancy (Okado et al. 2000). A 9-year follow-up study involving 6921 people compared the mortality rate between those rating their health status as very good and poor, and reported that the latter's rate was two- and five-fold higher among males and females, respectively (Kaplan and Camacho 1983). Some researchers regard self-rated health as a simple and excellent health assessment/health support tool that may facilitate interactive health support, as it is a voluntary health assessment, and the results reflect one's lifestyle and physical health status (Yamamoto et al. 2009). In addition, a study of the self-rated health of 5641 children up to the age of 18 years showed an association with depression (Okada et al. 2022). In view of the above, we used self-rated health because, in addition to making it possible for teachers themselves to understand their own physical and mental state, it can be used to support teachers' health.

We presented questions regarding physical and mental health conditions separately, to recognise the influences of mental disorders on the body: 'Do you generally consider yourself physically healthy?' and 'Do you generally consider yourself mentally healthy?' Both questions were answered by choosing one answer on a four-point scale ranging from 1 (very healthy) to 4 (not healthy).

**Depressive symptoms.** To measure depressive symptoms, we used the Japanese version of the Kessler Psychological Distress Scale (K6) developed by Kessler et al. (2002) and translated by Furukawa

et al. (2003). The K6 is an appropriate screening scale for the severity of depressive symptoms, the psychometric properties of which have been reported from a study of 3084 American Indians (Mitchell and Beals 2011). In addition, a study of 38,3745 randomly selected participants from the 2007 Comprehensive Survey of the Living Conditions of People on Health and Welfare (Nishi et al. 2012), a study of 818 people aged 15 to 64 years in Iran (Hajebi et al. 2018), the Canadian Community Health Survey-Mental Health of people aged 15–19 and 20–64 years (Ferro 2019), and a study of 1863 individuals drawn from the publicly available 2014 Health Center Patient Survey (Umucu et al. 2021), among others, have confirmed its reliability and validity.

The K6 is a six-item scale to assess and screen for depressive/anxiety disorders. For example, the question 'During the past 30 days, about how often did you feel nervous?' is answered by choosing the most appropriate answer from 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time', and 'All of the time'. 'None of the time' and 'All of the time' are scored 0 and 5, respectively. The full score is 24, and we recommended that the cut-off point be  $\geq 5$ . Thus, a score of  $\geq 5$  indicated a risk of depressive symptoms, such as mood/anxiety disorders (Sakurai et al. 2011). Living conditions and interactions with others also influence self-rated and mental health (Iwagaki 2021). We used the mean K6 score to assess the overall situation in this study.

**Collaboration.** First, when explaining this study, we asked survey participants, 'Have you ever heard of the OODA loop?' and 'If you have heard of it, what do you know about its meaning?' In addition, the participants were asked, 'Have you ever received training specifically on coordination and collaboration?'; those who had received such training were asked to respond, by a show of hands, to the questions, 'Have you heard of the OODA loop? Are you aware of it?' and 'What kind of training did you receive on coordination and collaboration?'

To assess collaboration, we presented the question, 'Have you ever collaborated/cooperated with other professionals (institutions) to manage affairs related to children?'; the response options were 'Yes' or 'No'. Then, we asked those with a 'Yes' answer to indicate whether they were satisfied with the current status of collaboration and cooperation. They were also asked to describe their reasons in the space provided for each, and we analysed the content.

As we found no measures pertaining directly to the OODA loop in the educational context, we referred to a number of practical papers on collaborative cooperation (Bridges et al. 2011, Bronstein 2003, D'Amour et al. 2005, Folkman et al. 2019, Gardner et al. 2022, Ko et al. 2008, Notko et al. 2022, Reeves et al. 2018, Schot et al. 2020) and incorporated findings from OODA loops in other contexts (Husáka et al. 2022, Vettorello et al. 2019, Villars et al. 2008, Wickramasinghe et al. 2009).

Based on the findings extracted from the above, to examine the feasibility of promoting collaboration based on the OODA loop, we developed an original scale to measure attitudes towards using the OODA loop for the organic collaboration necessary to make decisions to manage various risks with flexibility. We formulated 17 questions about collaboration and cooperation based on previous findings (Harada 2020, Irie 2019, Richards 2004, translated by Harada 2019), which explain the basics of the OODA loop. For example, the question 'Are you quick to notice what is important?' was answered by choosing the most appropriate answer from 'None of the time', 'A little of the time', 'Some of the time', 'Most of the time', and 'All of the time'. 'None of the time' and 'All of the time' were scored 1 and 5, respectively.

**Ethical considerations.** Before conducting the questionnaire survey, we visited the relevant sites to distribute an explanatory

document to obtain consent and provided oral explanations of the study. We carefully explained the study objective and ethical considerations to obtain the participants' written informed consent. Further, we clarified that it was possible to refuse to participate; there would be no disadvantage for not cooperating; the questionnaire was anonymous to prevent the identification of individuals; all results would be statistically processed and used only for purposes related to the study objective; and all responses were based on respondents' free will. However, when the survey simultaneously involved all employees of a school or organisation, such as the office of a board of education, the signature of the person responsible or head of the relevant department was deemed indicative of consent. The study was approved by the Medical Ethics Committee of our institution (BLINDED FOR REVIEW). All procedures were carried out in accordance with the standards of the institutional ethics committee and the 2013 revision to the Declaration of Helsinki.

**Analytical methods.** We used SPSS Statistics 28.0J for Windows (IBM Corp., Tokyo, Japan) for all questionnaire results. We conducted a factor analysis (unweighted least squares and promax rotation) on the sense of cooperation and collaboration to turn the OODA loop. We conducted a point-biserial correlation to determine the association between scale factors and satisfaction. In addition, Tukey's honestly significant difference test was used to conduct a profession-specific analysis of variance for mental health, sense of collaboration to turn the OODA loop, and K6 for multiple comparisons. In addition, *t*-tests were conducted for presence of collaborative cooperation and satisfaction/dissatisfaction with collaborative cooperation. All significance levels were set at 5%. Furthermore, we analysed the free descriptions through discussions among the researchers, collaborative researchers, and cooperators.

**Results**

**Knowledge of OODA loop and participation in collaborative training.** First, we noted the participants' demographics and their awareness of the OODA loop and whether or not they had any training experience in collaboration and cooperation (Table 1). None of the respondents had heard of the OODA loop, and none of them knew what the abbreviation stood for. Furthermore, none

of the respondents had received training on coordination and collaboration.

**Factor analysis and naming of each factor.** We performed factor analysis (unweighted least squares, promax rotation) of the 17 scale items to measure attitudes towards collaboration and cooperation using the OODA loop, based on criteria of a loading of  $\geq 0.4$  on each factor and no overlap of multiple factors. Based on the results, we deleted one item, 'Always separating judgement and decision-making'. Subsequently, we performed a factor analysis of the remaining 16 items in the same way, where a three-factorial model was the most cohesive and appropriate. The initial eigenvalues ranged from 7.74 to 1.23, with a cumulative contribution of 63.0%. Table 2 shows the final factor correlations after promax rotation.

We named Factor 1 *flexible and independent situational assessment*, as there were greater loadings on 11 items regarding attitudes towards appropriately observing each case, with a full understanding of the current situation; quickly noticing abnormalities/changes; and adopting necessary actions: 'being quick to notice what is important', 'adopting flexible actions after noticing it', 'always making decisions independently in actual settings', 'always making decisions in real-time in actual settings', 'correctly interpreting (assessing) each situation from observation', and 'having the ability to accurately understand information and direct actions'. We named Factor 2 *group monitoring and sharing*, as there were greater loadings on four items regarding attitudes towards sharing knowledge, criteria, goals, and plans with other group members: 'sharing knowledge with other group members', 'sharing criteria with other group members', 'sharing goals with other group members', and 'sharing plans with other group members'. Lastly, we named Factor 3 *self-monitoring*, as there were greater loadings on two items regarding attitudes that emphasise the importance of being self-conscious and appropriately monitoring oneself: 'always making sure not to act on assumptions' and 'always making objective observations'.

**Reliability of the scale.** To verify the reliability related to internal consistency among Factors 1–3, we calculated Cronbach's alpha for each subscale and obtained the following values: Factor 1:  $\alpha = 0.909$ , Factor 2:  $\alpha = 0.882$ , and Factor 3:  $\alpha = 0.665$ . Thus, the scale was shown to have sufficient reliability.

**Validity of the scale.** Content validity was confirmed by verifying whether the measurement items were selected without bias from the field among education professionals: school nurses, healthcare professionals, including doctors and nurses, and welfare professionals, including social workers.

We performed point-biserial correlations to determine the association between the three factors extracted in the factor analysis and satisfaction or dissatisfaction with the current status of collaboration and cooperation. The results showed that there was a positive and statistically significant correlation between Factors 1, 2, and 3 and satisfaction/dissatisfaction with the current status of collaboration and cooperation ( $r_{pb} = 0.204$ ,  $n = 136$ ,  $P = 0.017$ ,  $r_{pb} = 0.197$ ,  $n = 136$ ,  $P = 0.022$  and  $r_{pb} = 0.175$ ,  $n = 136$ ,  $P = 0.041$ , respectively). The validity of this scale was tentatively ensured, but further validity studies need to be conducted over time (Table 3).

**Self-rated health, sense of collaboration in the OODA loop and K6 for each profession.** To examine differences in self-rated health (physical and mental), sense of collaboration in the OODA loop, and K6 among teachers, administrators, medical professionals, counsellors, and other support professionals, Tukey's

**Table 1 Attributes of 'experienced' and 'not experienced' in collaborative cooperation.**

	n	%	Knowledge of OODA	Training experience in collaboration
Men	82	48.0	No	No
Women	88	51.5	No	No
Other	1	0.6	No	No
20 s	18	10.5	No	No
30 s	36	21.1	No	No
40 s	62	36.3	No	No
50 s	39	22.8	No	No
60 s	16	9.4	No	No
Teacher	118	69.0	No	No
Guidance officer	29	17.0	No	No
Healthcare worker	6	3.5	No	No
Counsellor	11	6.4	No	No
Other supporters	7	4.1	No	No

OODA Observe-Orient-Decide-Act.

**Table 2 Factor analysis of the scale to measure attitudes towards collaboration and cooperation using the OODA loop.**

Item	Factor loadings		
	I	II	III
Flexible and independent situational assessment ( $\alpha = 0.909$ )			
Being quick to notice what is important	<b>0.666</b>	-0.022	0.183
Adopting flexible actions after noticing it	<b>0.756</b>	-0.090	0.034
Constantly updating information	<b>0.445</b>	-0.025	0.251
Always keeping up with the changing times	<b>0.463</b>	-0.075	0.359
Always making decisions independently in actual settings	<b>0.730</b>	0.039	0.036
Always making decisions in real-time in actual settings	<b>0.832</b>	-0.071	-0.062
Correctly interpreting (assessing) each situation from observation	<b>0.671</b>	-0.019	0.219
Lessons learned from post-action reflections being applied	<b>0.544</b>	0.166	0.117
Always acting on the best hypothesis	<b>0.624</b>	0.130	-0.004
Having the ability to accurately understand information and direct actions	<b>0.763</b>	0.025	-0.042
Group monitoring and sharing ( $\alpha = 0.882$ )			
Sharing knowledge with other group members	0.352	<b>0.585</b>	-0.220
Sharing criteria with other group members	0.399	<b>0.651</b>	-0.279
Sharing goals with other group members	-0.165	<b>0.915</b>	0.204
Sharing plans with other group members	-0.198	<b>0.925</b>	0.191
Self-monitoring ( $\alpha = 0.665$ )			
Always making sure not to act on assumptions	-0.018	0.063	<b>0.688</b>
Always making objective observations	0.374	0.003	<b>0.491</b>
Parasitic rate (%)	43.025	8.390	4.682
Inter-factorial correlation	I	II	III
II	0.555		
III	0.455	0.291	

OODA Observe-Orient-Decide-Act.  
The bold text indicates which numerical values each of Factor 1, Factor 2, and Factor 3 comprise.

**Table 3 Point-biserial correlations between 'satisfaction/dissatisfaction with the current status of collaboration and cooperation' and the three factors identified through factor analysis.**

	Satisfaction/dissatisfaction with the current status of collaboration and cooperation
Flexible and independent situational assessment	0.204*
Group monitoring and sharing	0.197*
Self-monitoring	0.175*

\* $P < 0.05$ .

honestly significant difference test was used to conduct an analysis of variance based on gender and school type, and multiple comparisons were made. The results showed no significant differences (Table 4).

**Experience of collaboration and cooperation and satisfaction/dissatisfaction with the current status of collaboration and cooperation.** We analysed responses regarding the experience of collaboration and cooperation and satisfaction/dissatisfaction with the current status of collaboration and cooperation to examine the relationship between them (Tables 5 and 6).

The numbers of respondents who indicated that they had experienced and not experienced collaboration and cooperation were 136 (79.5%) and 35 (20.5%), respectively. Among the 136 with experience of collaboration and cooperation, 101 (74.3%) and 35 (25.7%) were satisfied and dissatisfied with the current status of collaboration and cooperation, respectively.

**Experience of collaboration and cooperation, self-rated health, attitudes towards collaboration and cooperation, and K6 scores.** To examine differences in physical and mental self-rated health, attitudes towards collaboration and cooperation using the OODA loop, and K6 scores between respondents with and without experience of collaboration and cooperation, we conducted a *t*-test. Table 7 shows the results. There were no significant differences in any item.

**Satisfaction/dissatisfaction with the current status of collaboration and cooperation, self-rated health, attitudes towards collaboration and cooperation, and K6 scores.** We also conducted a *t*-test to examine differences in physical/mental self-rated health, attitudes towards collaboration and cooperation using the OODA loop, and K6 scores between respondents who were satisfied and dissatisfied with experiences of collaboration and cooperation. Table 8 shows the results. There were significant differences in all items except for K6 scores: self-rated health (physical): ( $t(134) = 2.111, P = 0.037, d = 0.414$ ); self-rated health (mental): ( $t(134) = 2.064, P = 0.042, d = 0.333$ ); attitudes towards collaboration and cooperation using the OODA loop—*flexible and independent situational assessment* (Factor 1): ( $t(134) = 2.406, P = 0.017, d = 0.472$ ); *group monitoring and sharing* (Factor 2): ( $t(134) = 2.073, P = 0.043, d = 0.456$ ); and *self-monitoring* (Factor 3): ( $t(134) = 2.060, P = 0.041, d = 0.404$ ).

**Specific reasons for satisfaction/dissatisfaction with the current status of collaboration and cooperation.** Five researchers (two men and three women) analysed the free-text data. All of them have a medical degree and their occupations include: three university professors (doctor, nurse, and clinical psychologist); one psychiatrist working in a hospital, qualified as an occupational physician; and three public health physicians, qualified as occupational physicians working in a health centre. The commonalities between the written descriptions of reasons for satisfaction

**Table 4 Self-rated health, attitudes towards collaboration and cooperation, and K6 scores in each profession.**

	Self-rated physical health		Self-rated mental health		Flexible and independent situational assessment		Group monitoring and sharing		Self-monitoring		K6 scores		
	n	Mean ± SD	F value	Mean ± SD	F value	Mean ± SD	F value	Mean ± SD	F value	Mean ± SD	F value	F value	
Teacher	118	3.13 ± 0.48	0.847	3.07 ± 0.58	0.660	3.44 ± 0.60	0.778	3.29 ± 0.74	1.082	3.72 ± 0.74	0.682	4.47 ± 4.49	1.586
Guidance officer	29	3.00 ± 0.46		2.93 ± 0.53		3.27 ± 0.51		3.10 ± 0.66		3.50 ± 0.52		5.45 ± 4.34	
Healthcare worker	6	2.83 ± 0.41		2.83 ± 0.41		3.23 ± 0.40		3.29 ± 0.60		3.75 ± 0.52		7.17 ± 4.79	
Counsellor	11	3.09 ± 0.54		3.09 ± 0.30		3.38 ± 0.72		3.48 ± 0.77		3.73 ± 0.90		5.00 ± 4.20	
Other supporters	7	3.14 ± 0.69		3.14 ± 0.38		3.56 ± 0.48		3.64 ± 0.72		3.86 ± 0.63		1.71 ± 1.89	
			<i>P</i> = 0.497		<i>P</i> = 0.620		<i>P</i> = 0.541		<i>P</i> = 0.367		<i>P</i> = 0.605		<i>P</i> = 0.180

All data are presented as mean ± SD; one-way analysis of variance with post hoc Tukey's test was applied for significance testing; SD standard deviation.

**Table 5 Attributes of 'experienced' and 'not experienced' in collaborative cooperation.**

	Experienced <i>n</i> = 136		Not-experienced <i>n</i> = 35	
	<i>n</i>	%	<i>N</i>	%
Men	72	52.9	16	45.7
Women	63	46.3	19	54.3
Other	1	0.7	0	0.0
20 s	13	9.6	5	14.3
30 s	29	21.3	7	20.0
40 s	48	35.3	14	40.0
50 s	34	25.0	5	14.3
60 s	12	8.8	4	11.4
Teacher	92	67.6	26	74.3
Guidance officer	26	19.1	3	8.6
Healthcare worker	5	3.7	1	2.9
Counsellor	8	5.9	3	8.6
Other supporters	5	3.7	2	5.7

**Table 6 Attributes of 'satisfied' and 'dissatisfied' in collaborative cooperation.**

	Satisfied <i>n</i> = 101		Dissatisfied <i>n</i> = 35	
	<i>n</i>	%	<i>n</i>	%
Men	54	53.5	18	51.4
Women	47	46.5	16	45.7
Other	0	0.0	1	2.9
20 s	11	10.9	2	5.7
30 s	20	19.8	9	25.7
40 s	39	38.6	9	25.7
50 s	26	25.7	8	22.9
60 s	5	5.0	7	20.0
Teacher	67	66.3	25	71.4
Guidance officer	20	19.8	6	17.1
Healthcare worker	4	4.0	1	2.9
Counsellor	5	5.0	3	8.6
Other supporters	5	5.0	0	0.0

and dissatisfaction were extracted, summarised in a table, and classified into three categories: details of collaboration and cooperation, methods of collaboration and cooperation, and organisations for collaboration and cooperation (Table 9).

The reasons for satisfaction with the details of collaboration and cooperation included fulfilling and sufficient interprofessional collaboration, such as 'sharing information and receiving appropriate advice on support methods', 'obtaining information regarding future management approaches', 'being able to consult about the goals of support', and 'obtaining professional advice'. In contrast, the reasons for dissatisfaction with this category included insufficiencies: 'lack of information and effective measures', 'insufficient communication', 'insufficient sharing of support methods', and 'simply exchanging information'.

In the reasons for satisfaction with the methods of collaboration and cooperation, the participants mentioned smooth case management, such as 'facilitating appropriate management', 'allowing regular support approaches and interviews', 'leading to the next stage', and 'promoting cooperative attitudes among professionals'. The reasons for dissatisfaction with this category included difficulties related to case management, such as 'slow response', 'no progress in case conferences', 'only sharing but not finding solutions', and 'not leading to specific actions'.

**Table 7 Experience of collaboration and cooperation, self-rated health, attitudes towards collaboration and cooperation and K6 scores.**

	Self-rated physical health		Self-rated mental health		Flexible and independent situational assessment		Group monitoring and sharing		Self-monitoring		K6 scores	
n	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value
Experienced	3.09 ± 0.48	-0.281	3.04 ± 0.53	0.150	3.44 ± 0.58	1.490	3.29 ± 0.73	0.060	3.74 ± 0.71	1.920	4.63 ± 4.18	-0.100
Not experienced	3.11 ± 0.53		3.03 ± 0.62		3.28 ± 0.56		3.28 ± 0.70		3.49 ± 0.65		4.71 ± 5.31	
		$P = 0.779$		$P = 0.881$		$P = 0.138$		$P = 0.953$		$P = 0.057$		$P = 0.992$

All data are presented as mean ± SD.  
Differences between experienced and not-experienced were analysed using the t-test.  
SD standard deviation.

**Table 8 Satisfaction/dissatisfaction with the current status of collaboration and cooperation, self-rated health, attitudes towards collaboration and cooperation and K6 score.**

	Self-rated physical health		Self-rated mental health		Flexible and independent situational assessment		Group monitoring and sharing		Self-monitoring		K6 scores	
n	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value	Mean ± SD	t value
Satisfied	3.14 ± 0.49	2.110	3.09 ± 0.57	2.064	3.51 ± 0.58	2.406	3.37 ± 0.67	2.073	3.81 ± 0.70	2.060	4.55 ± 4.40	-0.368
Dissatisfied	2.94 ± 0.42		2.91 ± 0.37		3.24 ± 0.54		3.04 ± 0.85		3.53 ± 0.72		4.86 ± 3.52	
		$P = 0.037$		$P = 0.042$		$P = 0.017$		$P = 0.043$		$P = 0.041$		$P = 0.714$

All data are presented as mean ± SD.  
Differences between satisfied and dissatisfied were analysed using the t-test.  
SD standard deviation.



**Table 9 Specific reasons for satisfaction/dissatisfaction with the current status of collaboration and cooperation.**

Items	Reasons for satisfaction	Reasons for dissatisfaction
Details of collaboration and cooperation	Sharing information and receiving appropriate advice on support methods	Lack of information and effective measures
	Obtaining information regarding future management approaches	Lack of concrete support measures and planning
	To be reassured by the professional's opinion	Insufficient communication
	Being able to consult about the goals of support	Insufficient sharing of support methods
	Enabling learning in a developmental and forward-looking way	Lack of specific measures or instructions
	Obtaining professional advice	Simply exchanging information
Methods of collaboration and cooperation	Facilitating appropriate management	Lack of insight and advice
	Allowing regular support approaches and interviews	Slow response
	Enabling working together	No progress in case conferences
	Leading to the next stage	Failure to reach expected initiatives
	Appropriate and enthusiastic response	Only sharing but not finding solutions
	Promoting cooperative attitudes among professionals	Lack of common assessment
Organisations for collaboration and cooperation	Enabling discussion	Not leading to specific actions
	Multi-professional collaboration and consultation should be possible	Insufficient number of employees
	Enabling working together in each situation	Organised relocation of employees
	Promoting role-sharing	Differences in working methods
	Enabling working together in student guidance cases	Lack of role clarification
	Enabling working with doctors in medical cases	Failure to reach an awareness of their respective positions
	Enabling receiving advice from professionals	Insufficient time
	Enabling proceeding through each step through collaboration	Insufficient interactions
	Promoting cooperative attitudes among professionals	Not acting until things get serious
	Leading to a change in the way people work	Only working within the authority of respective positions
	Obtaining referrals to external agencies	Lack of information sharing
		Different perspectives

The reasons for satisfaction with organisations for collaboration and cooperation involved organisational unity, such as ‘enabling discussion’, ‘enabling cooperative work on each situation’, ‘promoting role-sharing’, ‘enabling proceeding with each step through collaboration’, and ‘promoting cooperative attitudes among professionals’. The reasons for dissatisfaction with this category included organisational functioning issues, such as ‘insufficient number of employees’, ‘organised relocation of employees’, ‘insufficient time’, ‘insufficient interactions’, and ‘different perspectives’.

**Discussion**

We conducted a questionnaire survey involving teachers and other educational personnel to promote measures to prevent suicide among children by forming systems for interprofessional collaboration between educational and other institutions to appropriately manage high-risk children. We examined collaboration and cooperation systems and their details, as well as self-rated health and mental health status, among the participants.

**Mental health status among teachers and other educational personnel.** No significant differences were found with respect to mental health by teacher and educational staff attributes. Further, there were no differences in mental health with respect to professional positions in the collaborative system. There were also no significant differences in mental health status between respondents with and without experience of collaboration and cooperation. Therefore, the results indicated that differences in professional status and the presence or absence of experience in cooperative work did not affect mental health.

In contrast, among respondents with experience, the self-rated health scores of those who were dissatisfied with the current status of collaboration and cooperation were lower than the scores of those who were satisfied. It appeared that satisfaction or dissatisfaction with the cooperative collaboration affected their own mental health. However, there were no significant differences in depressive symptoms between satisfied and dissatisfied participants. Despite this finding, as there is a reported association between poor self-rated health and depression (Iwagaki 2021, Okada et al. 2022), it may be necessary to provide mental and physical care for those who are dissatisfied with the current status of collaboration and cooperation, even if they are not yet in a depressed state.

**Attitudes towards the OODA loop.** We developed a scale to measure attitudes toward the OODA loop and used it for a survey. We confirmed that the scale has sufficient reliability, content validity, and a positive correlation with satisfaction in collaboration and cooperation. When we examined the content validity of this three-factorial scale, we found that it included typical items that proceed rapidly and smoothly through the four steps comprising the OODA loop—*Observe*: ‘Are you quick to notice what is important?’ and ‘Do you always update your information?’; *Orient*: ‘Do you always make decisions independently in actual settings?’ and ‘Do you always make decisions in real-time in actual settings?’; *Decide*: ‘Do you correctly interpret (assess) each situation from observation?’ and ‘Do you share goals with other group members?’; and *Act*: ‘Do you apply the lessons learned through reflection after each action?’ and ‘Do you always act with the best hypothesis?’ Therefore, the scale to evaluate attitudes towards the OODA loop may also sufficiently apply to case conferences and subsequent reflections.

The survey to examine attitudes towards the OODA loop compared respondents with and without experience of collaboration and cooperation and did not reveal significant differences, suggesting that those without experience possibly had no idea of realised collaboration and cooperation and, therefore, only described their ideals regarding collaboration, as its importance in regular training settings, such as annual training sessions, is emphasised (Ministry of Education, Culture, Sports, Science and Technology 2021a, 2022). In contrast, respondents who were dissatisfied with the current status of collaboration and cooperation showed passive attitudes. Their scores for all factors, 'flexible and independent situational assessment', 'group monitoring and sharing', and 'self-monitoring', were lower, suggesting that those who are satisfied are positive about adopting OODA perspectives when collaborating and cooperating, whereas those who are dissatisfied rarely adopt such perspectives. For example, the PDCA cycle does not allow flexible adaptations when there are sudden changes in external factors during the process of case management, which was cited as a disadvantage (Ohnishi and Fukumoto 2016). This makes it difficult for team members to share the purposes of collaboration and causes differences in perspectives, which may be a barrier to collaboration based on each professional's speciality and experience. Especially in the OODA loop, decision-making is important, as it is the basis for how problems are addressed (Dag et al. 2008). In clinical practice, responding to important changes made to the treatment plan based on iterations of the OODA loop is required (Villars et al. 2008), suggesting that those who are dissatisfied are not even aware of important changes. It was also apparent that it is important to try to control or shape the future, rather than foresee it, and not to look ahead and create potential pathways for innovation (Vettorello et al. 2019). Decision-making is generally complex and unstructured, but to make effective choices when faced with numerous options, decision-makers must collect multispectral data and information (Wickramasinghe et al. 2009). In other words, although information was obtained, a decision-making process that efficiently utilises the knowledge gained from that information may have been lacking.

**Current status of collaboration and cooperation.** Regarding the content of collaboration, the importance of evaluation has been described in interventions to improve patient care in IPE (Reeves et al. 2018). When focusing on the details of collaboration and cooperation, respondents who were satisfied with the current status found advice and opinions from external experts reassuring and were satisfied with visualised future support approaches and goals. In contrast, those who were dissatisfied may not have found collaboration and cooperation meaningful, as they were unable to obtain expert opinions and advice. By only exchanging information, they also lacked specific approaches and instructions. As they have not been provided with the necessary knowledge elements to ensure that healthcare decision-making process outcomes are optimised for maximal patient benefit (Wickramasinghe et al. 2009), they tend to be slow to respond, are unable to find solutions, and experience frustration over the lack of progress in collaboration and cooperation.

Regarding methods of collaboration and cooperation, systems for appropriate management and regular support approaches may have been available for satisfied respondents. In contrast, dissatisfied respondents may have been frustrated by slow responses, no solutions, and difficulty in proceeding with collaboration and cooperation. This is partly because while managers in the field should be aware of potential challenges when trying to integrate different professions to establish new professional roles and competencies (Folkman et al. 2019), in reality, it is unclear who

the managers are, and the managers themselves have not reached the point of experiencing challenges. Coordinated collaboration also requires bridging professional, social, physical, and task-related gaps, negotiating overlapping roles and tasks, and creating space for this to happen (Schot et al. 2020). It is then necessary to have an awareness of the OODA loop, which would serve as a guideline for handling incidents quickly and error-free, and the key is how this could be organised (Husáka et al. 2022).

Lastly, concerning organisations for collaboration and cooperation, satisfied respondents may have had a sense of working together with other collaborators, and sufficient role-sharing and cooperative attitudes among all members may have fostered security. Their satisfaction may have resulted from working with a sense of organisational unity. In contrast, dissatisfied respondents mentioned organisational functioning issues, such as a structure with an insufficient number of employees or organised relocation of employees. Insufficient time is another barrier to collaboration and cooperation.

**Conclusions.** The level of satisfaction with the current status of collaboration and cooperation is significantly related to self-rated mental health. Those who were satisfied were more positive about adopting OODA perspectives than those who were dissatisfied, which was also suggested to influence self-rated health and mental health.

Raising awareness of the OODA concept among teaching personnel, as well as creating an organisational structure around the administrators for this purpose, may be necessary to effectively use the OODA loop for collaboration and cooperation.

**Limitations.** Despite providing valuable findings on collaboration and cooperation between schools and various professionals in medical/welfare institutions, the study has some limitations. First, we only included participants from five prefectures rather than using a nationally representative sample. Second, our assessment method was limited to a questionnaire survey. Other methods, such as interviews, could be utilised. Moreover, the same survey should be conducted in other countries, as Japan's unique culture may have influenced the results. Therefore, in the future, it may be necessary to conduct more detailed interviews with teaching personnel who have experienced collaboration and cooperation and are satisfied/dissatisfied with its current status, to incorporate the OODA loop into organisational collaboration and cooperation, and to carefully analyse the obtained data. Another future challenge would be to include the perspectives of external support institutions to promote organic collaboration. Accounting for these, it is important to promptly establish systems for appropriate and organic collaboration between schools and medical/welfare institutions.

#### Data availability

All data generated or analysed during this study are included in this published article.

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## Author contributions

TS and HK contributed to the conception and design of this study. MO performed the statistical analysis and drafted the manuscript. YN and AF critically reviewed the manuscript and supervised the study process. All authors read and approved the final manuscript.

## Competing interests

The authors declare no competing interests.

## Ethics approval

The study was approved by the Medical Ethics Committee of Kochi University (FY 2020, approval number: 6). All procedures were carried out in accordance with the standards of the institutional ethics committee and the 2013 revision to the Declaration of Helsinki.

## Informed consent

All participants provided written informed consent.

## Additional information

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