

# Comparative Study of Recognition for Student Attention Analysis: YOLO-Based Face Detection in Classroom Environments

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## Middle school in Japan

- In Japan, strict rules and regulations are portrayed, but notification and recording of attendance data is very general.
- A record number of school children missed 30 or more days in the school year out of 240 school days in 2023 and is growing year by year.
- For middle schools 11.4% and for Elementary schools 24% from the previous year.
- The most common cause for non-attendance was “consultation over lack of motivation” at 32.2% “consultation over breakdown in routines” 23.0% “poor academic performance and regular failure to submit homework” 15.2%

Kyodo News (2023). Japan school absenteeism at record high of nearly 300,000 in FY 2022.  
Retrieved from <https://english.kyodonews.net>



## How to get the students back?

- Increase motivation to come to school and attendance
- **Focus on:**
  - “consultation over lack of motivation” 32.2%
  - “consultation over breakdown in routines” 23.0%
  - “poor academic performance and regular failure to submit homework” 15.2%
- Work with faculty and staff to help understand and support students
  - Motivate each other using Positive Behavior Support
  - Help change the mindset of coming to school to be rewarding

Kyodo News (2023). Japan school absenteeism at record high of nearly 300,000 in FY 2022.  
Retrieved from <https://english.kyodonews.net>



## Positive Behavior Support (PBS)

- **Positive Behavior Support (PBS)**
  - Set of strategies used to increase the quality of life and decrease problem behavior by teaching skills to manage and recognize changes in a student/teacher's environment change.
- **Positive reinforcement in the classroom**
  - Behavior reward system
    - Immediate Recognition
    - Individual points or token
    - Group/Class rewards

# Controlling behavior and teaching class #5

## Positive Behavior Support (PBS)

- Faculty and staff in the Japanese middle school have started training on using methods and strategies of Positive Behavior Support (PBS)
- **Concerns**
  - Effectively monitoring the students without affecting lecture and course deliverables
  - Logistics of monitoring and scoring student behavior by the end of class session
  - Reacting on individual bases and returning in supporting the class.



# Current method of PBS observation

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## Positive Behavior Support (PBS)

- **Faculty must observe students while teaching to react to attention degradation.**
  - Focus on individual students with behavioral habits that may disrupt class
  - Have extra support staff to aid and support student who have disruptive behavioral habits
  - Only give verbal praise
- **Disruptive behavior**
  - standing and walking around during lecture.
  - Heads down or sleeping



# Participation and preparation

#1

## Dr Kensuke Ishikawa

- Professor, College of Media and Information Science, Department of Psychological Information Design, Kanazawa Institute of Technology
- **Specialization**
  - Cognitive behavioral therapy, applied behavior analysis, developmental disorders, clinical behavior analysis, feedback from psychological tests
- In conjunction with a middle school in Japan with approval from the Prefecture and board of education and staff/students at the middle school



# Data collection and classroom monitoring

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## Camera

- Camera Panasonic HX-A1H
- Front of classroom and Rear of classroom







## CiRA Core IDE

- Running multiple types of image recognition and outputting data

CIRA.AI. (n.d.). Cognitive Interactive Real-time Assistant. Retrieved from <https://www.cira-ai.com/en>



# Recognition of students and tracking

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# Using the provided data for PBS reward #11

Behavior Category	Detected Behavior	Point Change	Criteria for Detection
Attention (Engagement)	Facing forward, looking at the teacher/slides	2	Face detection + gaze estimation
Attention (Distracted)	Looking down or away 50 min	-1	Face detection + gaze estimation
Staying in Seat	Remaining in assigned area	3	Movement tracking
Out of Seat	Leaving seat too often	-3	Movement tracking



# Teacher confirmation

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- **Real-Time Tracking & Feedback**
  - **Live Display:** Show students their engagement score on a dashboard.
  - **Discrete Alert** teachers if a student's engagement drops below a set threshold.
- **Teacher & Student Involvement**
  - **Teachers Set the Rules:** Adjust scoring weights and behaviors being tracked.
  - **Students Reflect on Scores:** They review **weekly reports** and set goals.
- **Challenges & Ethical Considerations**
  - **False Positives:** The AI must distinguish between **natural movement vs. distractions**.
  - **Fairness for Neurodiverse Students:** Adjust scoring criteria for students with ADHD or special needs.
  - **Privacy Concerns:** Ensure compliance with **local middle school and Prefectural Board of Education** by anonymizing data.
  - **Avoiding Over-Surveillance:** The system should **assist teachers, not replace them**.



# Model training of Students


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- Custom dataset was collected from the middle school on one day one classroom.
- Students wear a uniform but have option of active wear, short sleeve, long sleeve.
- Front view of class is used for this stage of the experiment
- Imbalance in pictures with student and teachers from the front view only



**Roboflow.** (n.d.). *Roboflow: Give your software the eyes it needs.* Retrieved from <https://roboflow.com>

CLASS ROOM GAZE



Student and t...  
Object Detection

DATA

- Upload Data
- Annotate
- Dataset 333
- Versions Train

**Analytics**

- Classes & Tags

MODELS

- Models
- Visualize

DEPLOY

- Deployments

## Dataset Analytics

Generated on February 19, 2025 at 5:35 pm [Regenerate](#)

### Number of Images

305

- 0 missing annotations
- 0 null examples

### Number of Annotations

7878

- 25.8 per image (average)
- Across 2 classes

### Average Image Size

2.07 mp

- from 2.07 mp
- to 2.07 mp

### Median Image Ratio

1920x1080

- wide

## Classes

Overview of the number of annotations for each class in your dataset.

Rebalance Splits

Download CSV

Search by class name

All Splits Train Valid Test

Sort

Student 7757

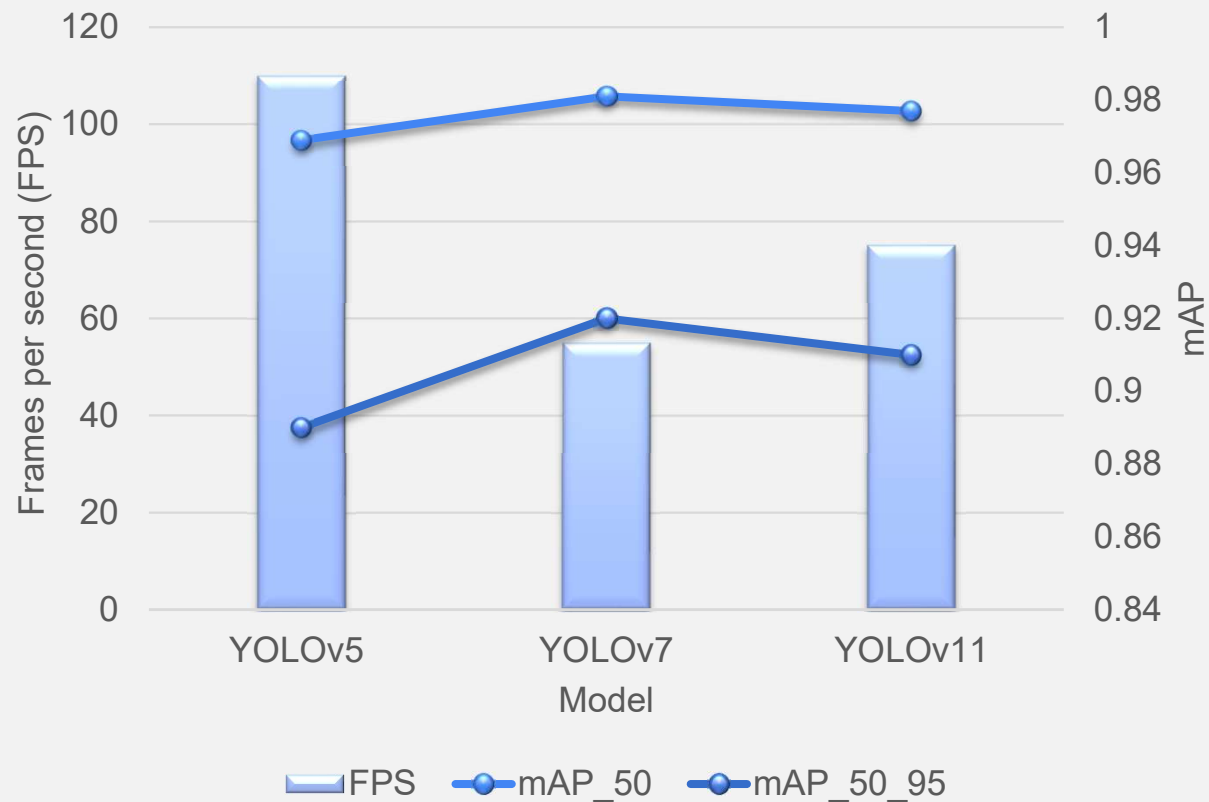
Teacher 121



# Yolo Results for Student Identification

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## Inference Speed vs. Accuracy



# Conclusion and future work

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- CiRA Core IDE can be used with a personal desktop and implemented with code easily and view any system issues easily and effectively.
- Blocks drop frame rate due to python code and detection
- The model dataset needs to be further improved to offset the underrepresented class of teacher
- Continued cooperation and support for Professor Ishikawa and the Japanese middle school.





# Conclusion and future work

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# Conclusion and future work

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# Future work

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## Addition

- Front of classroom and Rear of classroom



# Thank you for your attention!

