Utilizing smart environment in group play activities to screen and foster early skill development

## Aim of the course

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Play, and especially free play is the most important activity in childhood, with clear and long-lasting benefits for academic learning. Children develop various skills through play activities. It is voluntary, enjoyable, and pleasurable, supporting their understanding of the social world through interaction with the environment, including their peers. Observation of naturally occurring peer-to-peer interactions during play activities is a "goldmine" of useful data to characterize both individuals and group processes.
This course aims to provide insights to a novel, digital tool set for skill development: employing a smart environment to foster early skill development through play activities in child groups. Theoretical background will be provided to understand merits of group play activities, early skill development, and solutions for analyzing play behavior. We will utilize contemporary, automated, data-driven smart environments with wearable sensors for the students to experiment with. Building up a skill training protocol from ideas to pilot testing and refining the solution will be demonstrated through field studies in kindergartens and schools. Formulating and trying out the course participants' own initiatives are encouraged. The course will build practical knowledge utilizing contemporary, automated, data-driven solutions to extract and analyze vast amount of behavioral data from play activities in kindergarten groups collected by wearable devices.
Students attending this course will learn to use PLAY systems empowering smart environments, developed specifically for screening and development of motor, cognitive and social-emotional skills. For privacy reasons we do not use cameras in these environments. On the other hand, smart sensors are embedded into the infrastructure, toys and miniature wearable devices allowing the environment to calculate a rich set of objective, reproducible, psychologically relevant metrics for every child and object in real-time. These metrics grasp psychologically relevant features to portray skill-specific variables in the motor, cognitive and social domains (from throwing, catching, and balancing smart toys, to solving complex problems, empathy, or reaching a common goal through cooperative group play). Moreover, real-time data analysis enables instant and individually tailored feedback and/or adapt difficulty of the task to ensure personalized skill training for each child in the group playing together.

Course participants will acquire practical skills and learn for e.g:

- how can psychological tools (such as storytelling or group play activities) be embedded in the context of data-driven skill assessment and training,
- to use data from smart systems for measuring skill-related characteristics,
- to plan activities focusing on single or multiple skill training using smart environments,
- what are benefits and drawbacks of using such systems

## Learning outcome, competences

Knowledge:

- understanding the relation between early skill development and group play activities
- insights to modern, Data Science methods to analyzing behavior data related to the above

Attitude:

- scientific and empirical, with an emphasis on data-driven, practical solutions
- critical thinking in concluding research results

Skills:

- fluency in applying objective, real-time, data-driven solutions in skill assessment
- proficiency in setting up a smart environment and collecting data from wearable sensors

- ability to plan and carry out skill-focused measurements using data-driven solutions
- ability to formulate an independent opinion based on the topics and findings discussed

## Content of the course

### Topics of the course

The course starts with introducing relevant literature and providing theoretical background to the practical work ahead. Next, introduction and practical skills in using the smart environment for skill assessment and training through play activities will be initiated in the Adaptation Research Group's lab. Based on the acquired theoretical background, students are encouraged to try out play activities and develop their own ideas for skill training. Discussion about students' ideas and related results from prior research will be initiated, preparing for the main quest: focusing on a specific research or methodological question to be answered on the field with child groups in kindergartens or schools. Multidimensional data collected in real time will be analyzed using Data Science methods. We will accomplish analyses together; students are expected to understand outcomes of these analyses and formulate adequate conclusions.

- Introduction to the topics of group play activities, skill development and novel digital solutions for analyzing play behavior
- Practical sessions on using devices of the smart environment (lab work and experimentation)
- Choosing a group assignment to utilize acquired theoretical and practical knowledge and formulate a specific research question and/or skill training quest
- Field studies: participating in ongoing research activities of the Adaptation Research Group
- Introduction to the analyses of multidimensional wearable sensor data – questions and answers
- Completion and presentation of the group assignment: summarizing the question raised and related findings and experiences. In-class discussion of each assignment.
- Feedback and evaluation of the course, future directions

### Learning outcome, competences

Lectures, practical classes, lab work and own experience, participation in field studies, group assignments, presentation.

## Evaluation of outcomes

**Learning requirements, mode of evaluation, criteria of evaluation:**

The final grade will be based on

- quality and fluency of accomplishment of the group assignment
- activity on the classes.

## Reading list

**Compulsory and recommendes reading list**

Mandatory and recommended readings for the course will be specified and provided electronically in each semester. See readings on the topic below as examples:


Fisher K et al. (2010) Playing around in school: Implications for learning and educational policy DOI: 10.1093/oxfordhb/9780195393002.013.0025

Celia A. Brownell (2011) Early developments in joint action. https://link.springer.com/article/10.1007/s13164-011-0056-1

Hanish L. D., Martin C. L., Fabes R. A., Leonard S., Herzog M. (2005). Exposure to externalizing peers in early childhood: homophily and peer contagion processes. *Journal of abnormal child psychology*, *33*(3), 267–281. https://doi.org/10.1007/s10802-005-3564-6

Heravi B.M., Gibson J.L., Hailes S., Skuse D. (2018). Playground social interaction analysis using bespoke wearable sensors for tracking and motion capture Proceedings of the 5th International Conference on Movement and Computing, 1-8. https://www.researchgate.net/publication/326137665_Playground_Social_Interaction_Analysis_using_Bespoke_Wearable_Sensors_for_Tracking_and_Motion_Capture

Komatsubara T., Shiomi M., Kaczmarek T. *et al.* (2019) Estimating Children's Social Status Through Their Interaction Activities in Classrooms with a Social Robot. *Int J of Soc Robotics* 11**,** 35–48. https://doi.org/10.1007/s12369-018-0474-7