

Development of soft skills via IYPT – IO2 DIBALI



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- IO2 in DIBALI investigates how YPT participation relates to soft-skills
 - how the students develop **soft skills in IBL and PBL**
 - **how soft skills influence student performance** in inquiry-based learning (IBL) and problem-based learning (PBL) situations
- Methodological approach for understanding PBL success
 - Based on the **experiences of teachers** with these learning situations, a **questionnaire** capturing PBL was created
 - The questionnaires were **answered from students** (secondary schools) in the context of a PBL intervention
 - A **jury awarded grades** to the performance of students in PBL and IBL situations
 - The self assessments on **soft skills were compared** with the **grades** of the AYPT using regression models

- The Questionnaire asked the self assessment of the following soft skills:
 - Teamwork
 - Independent research
 - Scientific reasoning
 - Presentation skills
 - Debating skills
 - English skills
 - Problem-solving
 - Self-directed learning
 - Creativity

Excerpt from the questionnaire:

Q1 a) Please indicate how **important** you think the following skills are for success (as measure by jury evaluations) in AYPT: (1-5, not important-very important)

Q4) Please self-evaluate your **current proficiency** in the following skills: (relative to the average AYPT participant) (1-5, low-high)

Q5) Please self-evaluate your proficiency in the following skills **before your first participation** in AYPT: (relative to the average AYPT participant) *) (1-5, low-high)

Q8) How much has the preparation for AYPT helped you **develop** the following skills? (1-3, little- a lot)

Theoretical Background

IBL

- While IBL is most often connected with STEM courses, it is not limited to those subjects. In effect, IBL is used in a variety of subjects (Mieg, 2019).
- IBL involves scaffolding and guidance. Empirical data supports the positive effect of IBL on student performance (Hmelo-Silver et al., 2007).
- IBL leads to “transferable critical thinking skills as well as significant domain benefits, improved achievement, and improved attitude towards the subject.” (Hattie, 2009)

PBL

- In PBL, the approach how the problem is worked on and how the solution is found is considered the final product. (Hmelo-Silver et al., 2007)
- PBL is considered as a new method used in universities in US, UK and Asian countries. (Ansari et al., 2015)
- “This process have proved to enhance the soft skill, cognitive, metacognitive, problem solving and critical thinking skills among the students.” (Ansari et al., 2015, page 258)

soft skills

- “Skills (or competences) are defined as the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.” (OECD, 2012, page 12)
- “personal transversal competences such as social aptitudes, language and communication capability, ability of working in team, and other personality traits that characterize relationships.” (Cimatti, 2016, page 97)

Hypotheses on learning success

Research Question:

How does proficiency in soft skills influence student performance in IBL situations?

Hypothesis 1: The more important students gauge soft skills for success, the better their performance.

Hypothesis 2: The better the students self-assess their development of soft skills during the preparation period, the better their performance.

Hypothesis 3: The better students self-assess their teamwork skills, the better their performance.

Hypothesis 4: The better students self-assess their English skills, the better their performance.

- 12 Teams participated in 2020 and 2021. The **mean grade** was **6.24** (2020) and **6.54** (2021).
- For each soft skill, the students were asked to rate the **importance** for success, **self-assess** their proficiency **before** their very first AYPT and **after** the current preparation phase as well as the **development** in the soft skill during the preparation phase.
- There are approximately 800 jury grades in the analysis.
- Hypotheses were tested via hierarchical linear models.

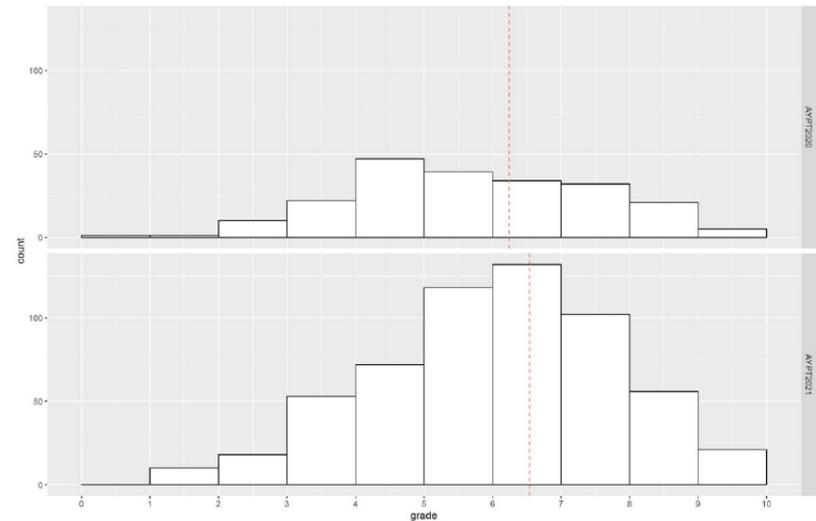


Figure 1: Distribution of grades per year (Figure 4 Schweighart,2021)

- The general importance of soft skills, the importance / development of certain soft skills, as well as the proficiency in English skills have an **influence on student performance**.
- Estimators do vary among the models being the lowest of 0.6473 **in model 1 including all control variables** and the highest in model 4 (**without any control variables**) amounting to 0.9916

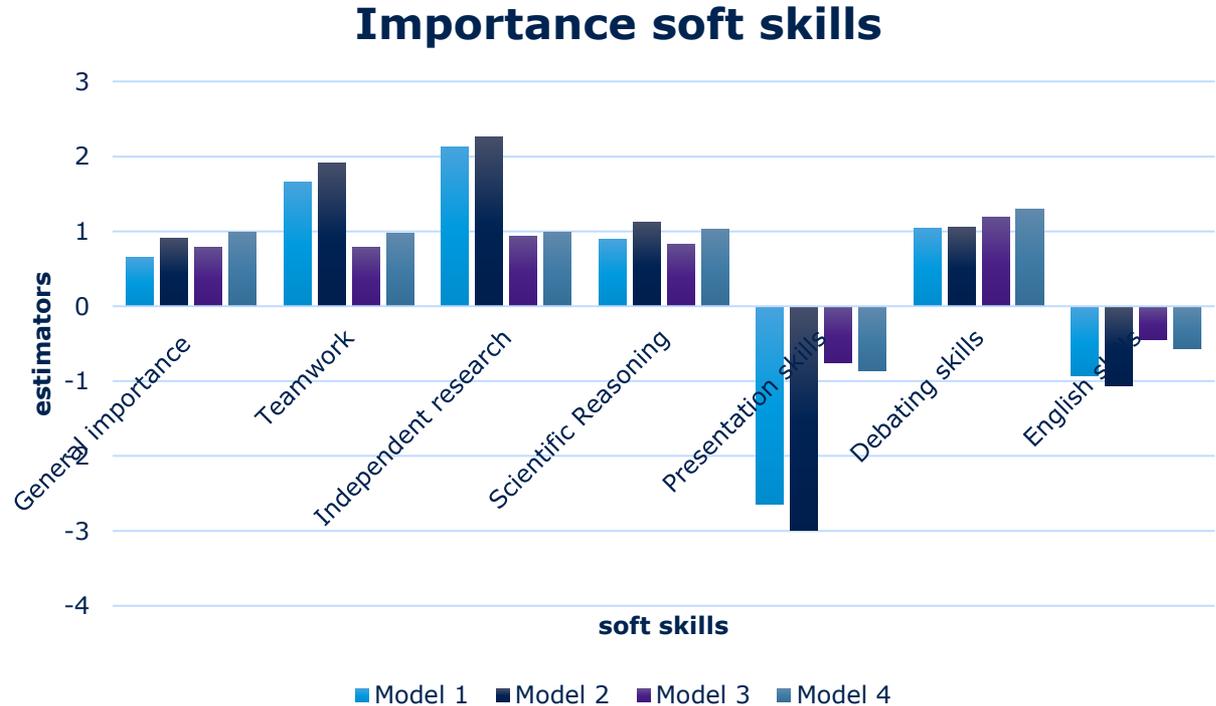


Figure 2: Regression Results for Importance of Soft Skills (Data taken from Table 4 and 5 Poier, 2021)

- The better students **self-assessed to be in soft skills due to the preparation for AYPT the better their grades** – except for presentation skills.
- Support could be observed: For **each additional hour** the students invest in the preparation for AYPT, their grades increase by 0.01 points.
- When analyzing the effect of the importance of individual soft skills, the **importance of teamwork, independent research, and debating skills had a positive impact.**
- Therefore, **student performance could be predicted** by the perceived importance of soft skills.
- The results showed that IBL led to **more soft skill development than traditional physics classes.**
- The **more hours** the students invested in preparation for AYPT, the better their grades.

- Possible **limitations** in the investigation lie in the fact that the data on **soft skills is based on self-assessment**. Thus, students possibly have different impression of their soft skills as opposed to reality. Other studies on IBL also faced this limitation by self-reported data from students and consequential “reporting and recall inaccuracies” (Jerrim et al., 2019, page 42).
- A clear positive link between student performance and soft skills **development could be observed for most skill types**.
 - the analysis **on the individual soft skill** level showed that a **positive relationship** could be observed for the development of teamwork, scientific reasoning, and English skills on grade.
 - A **negative influence** on grade was found for the development of **presentation and debating skills**.



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