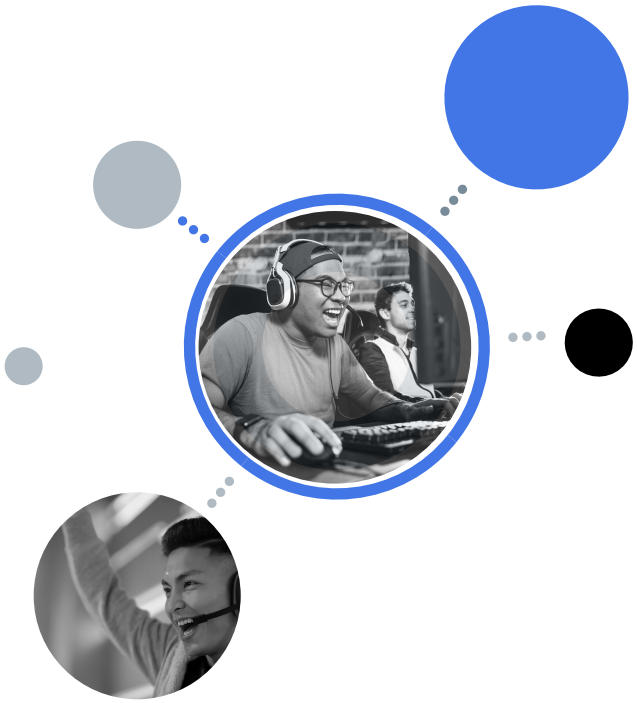
RESEARCH REPORT

wethink

2021

Introduction

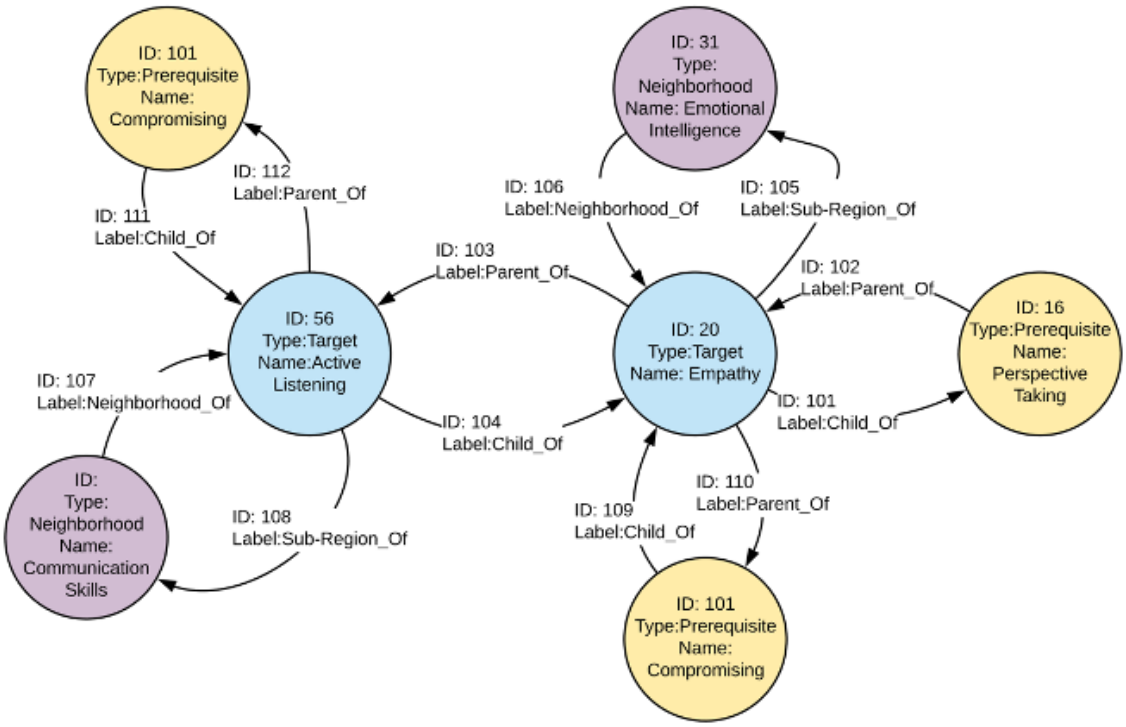
weThink developed, in collaboration with the University of Kansas' Achievement & Assessment Institute, proprietary skill models for meaningful, measurable, and malleable skills that span cognitive and non-cognitive domains including skills that directly relate to Social and Emotional Learning (SEL). These models include mechanisms for valid and reliable assessments and teachability via game-based learning or traditional learning interventions. This white paper is focused on weThink's current baseline implementation of the models within our application and discusses our strategies for improving reliability and validity within the application.



Skill Maps and Graph Theory

weThink's proprietary skill model is defined within a graph network where there are two types of objects.The first type of object is a NODE (vertex) which describes an entity or instance such as a skill or a person or an intervention or an assessment instrument. The second type of object is an EDGE which is a directional relationship between nodes. This enables weThink's models, algorithms, and software tools to leverage graph theory to rapidly develop solutions. In weThink's skill model there are three basic types of skill nodes:

- Prerequisite Skills enable a learner to acquire a target skill. Currently there are 115 of these nodes in the skill graph.
- Target Skills.There are 33 target skills that define the most meaningful, measurable, and malleable skills needed for humans to flourish across a wide range of scenarios and demographic categories.Appendix A lists references used to define attributes relating to each of these 33 skills.
- Neighborhoods. The 33 target skills are organized into 8 neighborhoods which simplify and consolidate the measurement, display and use of skills within decision support toolsets.



weThink's skill graphs may be integrated with graphs of interventions, assessments, and learners to form a robust graph network that may be transversed to find answers to complex questions, such as what peer match within a team and intervention would be best for developing Grit in a person with a particular existing profile, through games, models, algorithms, decision support tools, LMS functions, etc. The data in the graph network may also be consumed by machine learning algorithms that are able to cluster and classify nodes and edges with labels and types that are not obvious to human experts, further enhancing the skill graph's usefulness across a wide range of applications.

Stimulating Skill Development within Teams

Many human endeavors are team or small group oriented. Even in large organizations, high performing small teams are a fundamental element required to increase productivity (Guzzo & Dickson, 1996). Esports games like League of Legends (a video game version of "Capture the Flag" for a five-person team) are known to stimulate intense motivation and emotional triggers within small teams that may be used to observe, assess, and develop a subset of the weThink skill network.

Students who develop these skills have shown improved academic performance and are highly motivated to pursue STEM and to learn more about esports-related work. Given that girl gamers have been shown to select STEM degrees three times more often than non-gamers (Hosein, 2019), weThink's esports approach should be considered by organizations who value this increased propensity.

Although skills may be developed in any small group context, team-based esports is particularly useful for skill and expertise development. The table below is a summary of information which was primarily extracted from a research paper titled Esports: The Chess of the 21st Century (Pluss, et al., 2019).

OBSTACLES TO EXPERTISE DEVELOPMENT	ESPORTS OPPORTUNITIES
Bias in the recall of developmental activities	Developmental activities may be automatically tracked and logged online
Difficulty in developing ecologically valid tasks used to assess expertise	Constraints of representative tasks used to assess expertise correspond with real life performance
Challenges in capturing the influence of confounding factors	Confounding factors may be minimized and/or successfully replicated

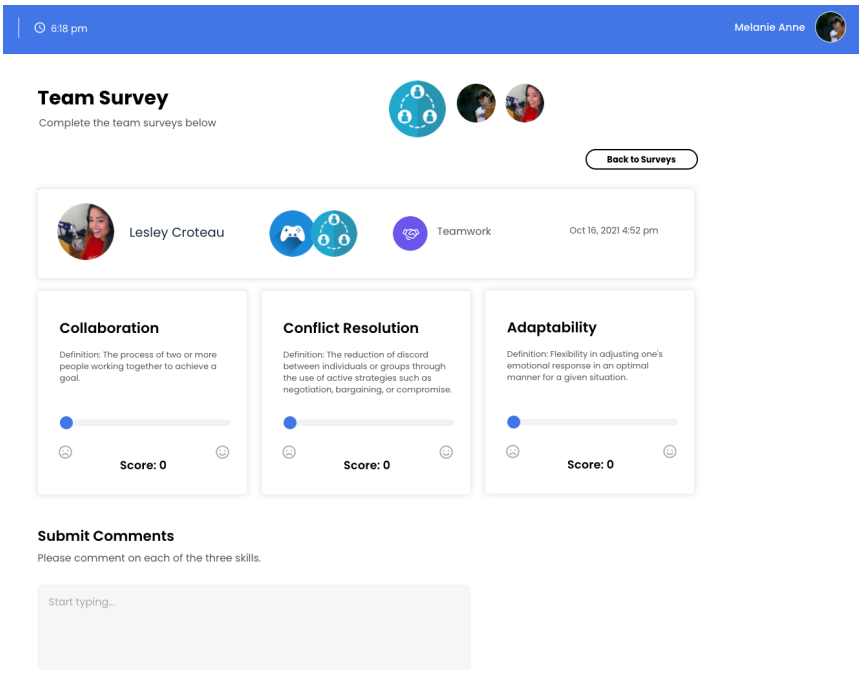
Chess was used in the 20th century to research expertise development because of its constraints and minimal confounding factors. As the article argues, esports is a better mechanism to explore expertise because it shares the attributes of chess but with several distinct advantages.One of the distinct advantages of esports over chess for studying and developing expertise is the team dimension.

Baseline Implementation

weThink's graph network was built to define the skills that were the most meaningful, measurable, and malleable within the human performance domain. A small subset of 15 target skills are uniquely suited for observable behaviors and assessment in the small team esports context.weThink's baseline implementation is a software application tool that clusters these skills in five general skill areas and enables self and peer assessment.

The baseline application supports the assessment and development of skills in conjunction with team activities. It was designed to be used in a session consisting of two cycles of: 1) skill discussion; 2) game play; 3) self reflection and skill self-assessment; 4) peer assessment; 5) discussion of opportunities to improve. This cycle produces subjective measurements of skills by the players in the game and it leads to the development of meta-skills including self-awareness, self-reflection, and self-regulation which are highly desirable in any human endeavor. The self and peer assessment data, which are subjective, are most useful for two purposes:

1. to establish trends in an individual or team over time
2. to establish relationships with more objective measures. The application shows the absolute values measured over time as well as derivative measures such as the difference between self assessments and peer assessments which may result in inferred self awareness scores.



Improving validity of assessments

weThink is continuing development of application and logic layer functions that will improve the validity of skill assessments in four areas:

- Expert Assessment: we have added the function of coach assessment of skills. This function may be used by any interested third party such as coach, teacher, parent, or mentor to add a more objective assessment of skills.

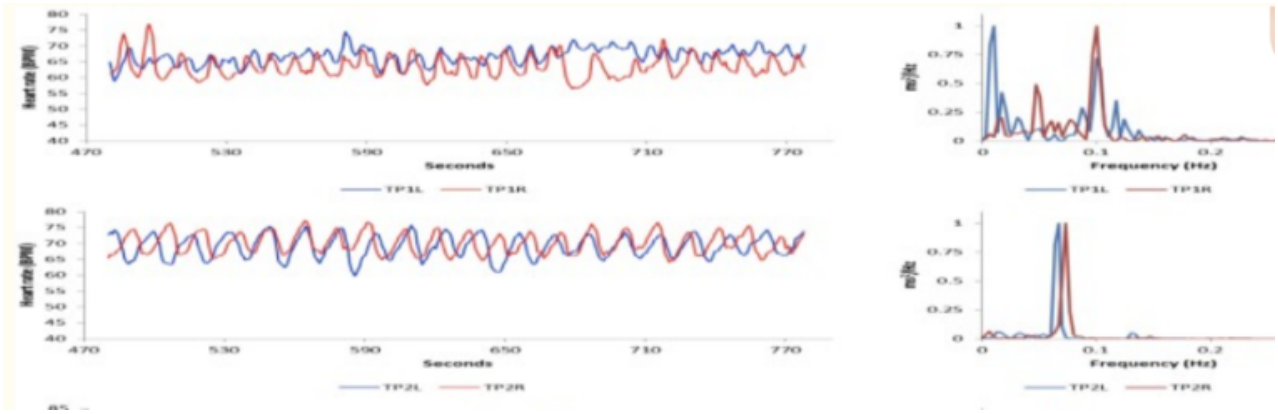
- Third party assessment instruments: There are a number of instruments that have been recognized to produce valid and reliable assessments which may be integrated into our application for use in “calibration” of the self and peer assessment metrics.

- Automated assessment of human characteristics:There are a significant number of observations that may be made automatically with common laptop or mobile-based technologies and combined with the assessment metrics. In addition to chat and voice analysis to extract inferred skill levels, one of the most exciting opportunities in this area is the concept of measuring and improving “team coherence” as discussed in the next section

- Machine Learning and Decision Support tools: information collected from the three areas above may be analyzed over time by algorithms to “tag” information with attributes that may be used to develop decision support tools that predict future individual and team states and prescribe intervention recommendations that may be most effective in improving individual and team performance. However, this approach may require several years of self and peer assessment data to produce valid and reliable recommendations.

Team Coherence and Performance

Automated assessment of human characteristics is a particularly cost effective mechanism to improve skill assessment data. Recent research (McCraty, 2017) into group coherence as measured by Heart Rate Variability (HRV) have created opportunities for improving team performance through improved prosocial behaviors, improved communication, and reduction in adversarial interactions within the group. In particular, pairwise HRV synchronization (or lack thereof as shown in the top pair) can quickly identify challenges in establishing connections between two players and can lead to rapid development of skills and resolution of intra-team conflict BEFORE it occurs. Additionally, machine learning algorithms have proven to accurately determine emotional state from HRV sensors 75% of the time (Leon, Clarke, Callaghan, & Doctor, 2010) indicating the possibility of a real time emotional feedback loop into the application and using it to improve skill development and team performance.



Summary

weThink's current application within the team esports context has been very effective at developing metaskills including self-awareness, self-reflection, and self-regulation as well as development of target skills. We are aggressively implementing software functions in the application that will add reliability and validity to the subjective self and peer assessment data.

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APPENDIX: TARGET SKILL REFERENCES

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