MAP-G

(Mindset Analysis using Psychometric Games)

Abstract

With the rise of Information Technology, there has been a monumental rise in the number of jobs in the industry. To counter the huge number of applications and to ensure that candidates of proper attitudes are selected, companies have tied up with psychologists to develop games that can measure favourable traits in the candidates.

This project is an attempt to develop a similar platform for evaluation of teachers, i.e., using Psychometric Games to measure and evaluate traits that are favourable for teachers to have.

Psychometric Games are a highly effective way to filter candidates to find their innate traits. Firstly, the candidates do not know that they are being tested, which ensures that they cannot put up a farce show, as it happens in interviews. Secondly, they provide and effective way to screen a large number of candidates for their psychological mindset, which otherwise is not possible.

A similar framework for teachers has a wide scope of application. It can be used for teacher hiring, evaluation, feedback and to ensure quality education and also suggest measures of improvement, if any, given that teaching is such a crucial field and affects the future of the country, i.e. children.

Introduction

Many people think of the brain as a mystery. They don’t know much about intelligence and how it works. When they do think about what intelligence is, many people believe that a person is born smart, average, or dumb and stays that way for life. Bur new research shows that the brain is more like a muscle-it changes and gets stronger when you use it. And scientists have been able to show how the brain grows and gets stronger when you learn.

1.1 Mindset

Mindsets are people's beliefs about human attributes, including abilities. In a fixed mindset, people believe that basic talents and abilities are fixed traits. Some people are well-endowed and some aren't, and you can't do much to change that. However, in a growth mindset, people believe that basic abilities can be developed through hard work, good strategies, and good

mentoring. People can have different mindsets in different areas, believing that some abilities are fixed but others can be developed. Within any given area, research has shown that people's mindsets play a significant role in their achievement.

Most of the research has been on students' mindsets about their intelligence and abilities. In the research, it has been found that students in a fixed mindset are overly focused on their ability. Research also shows that teaching students a growth mindset changes their motivation and achievement.

1.2 Growth Mindset vs Fixed Mindset

Fostering a growth mindset in students is a priority for most educators, but sometimes teachers themselves operate with a *fixed* mindset. Growth Mindset is the belief that one's abilities, qualities, and intelligence can be developed, while a fixed mindset believes that intelligence and one's qualities are unchangeable. Babies walk, they fall, they get up." Teachers need to show their students that they are a lifelong learner. There has also been work on the impact of teacher's mindsets about students' abilities. Teachers with more fixed mindsets engage in more ability grouping and create more self-fulfilling prophecies when it comes to student achievement.

1.3 Games in Mindset

By merging game-design thinking with trusted and proven psychometric principles, assessment games provide deep insight to inform better hiring decisions, and a rich, immersive experience for the candidate. Instead of asking the candidates to complete a test that feels like a test, they get to play a series of games. Game-based assessments are perfectly suited for measuring the critical cognitive skills. Gamers typically expend a high degree of cognitive resources whilst playing video and smartphone games, research has revealed. Thus, it is not surprising that games can be adapted to accurately and reliably measure cognitive abilities, as well as job-relevant personality traits. Also, their accuracy is similar (and increasingly higher!) when compared to longer and more repetitive text-based psychometrics. Game-based assessments can accurately evaluate fluid intelligence, working memory, problem solving, creativity etc.

The system we were aiming to develop is to build a comprehensive platform of psychometric games to quantify favorable traits for teachers and generate trait reports for the same and

perform analysis on the dataset thus formed to detect patterns and suggest measures for improvement.

BACKGROUND

People who have a growth mindset believe that intelligence can be developed, while people with a fixed mindset believe that intelligence is a fixed trait. People with a fixed mindset think of intelligence kind of like eye color. They believe that you're born with a certain amount of intelligence, and you can't do much to change that.

People with a growth mindset think of intelligence more like a muscle. They understand that when you put in effort and challenge yourself, you can get smarter, just like when you put in effort at the gym and challenge yourself by lifting heavier weights to make your muscles stronger.

Think about this statement: You can learn new things, but you can't really change your basic intelligence. People who really agree with this statement have a fixed mindset. People who really disagree with this statement have a growth mindset, and, of course, people might be somewhere in the middle. People with a growth mindset had more active brains than people with a fixed mindset when they got feedback that could help them learn. After performing poorly on a test, people with a growth mindset chose to learn from people who did better than them. People with a fixed mindset made them feel better by looking at the scores of people who did worse than them.

2.1 Growth Mindset of Teachers

Growth Mindset Teachers: “Every student has something to teach me” by Carol Dweck. Did they believe that teaching was simply a deep-seated natural ability or did they believe that teaching ability could be substantially improved over time? When they are in a fixed mindset, the child who has trouble learning something is a threat, a threat to the self-concept as a good teacher. In some cases, teachers just blame the child. Similarly, when they are in a fixed mindset, an unmotivated student or a disruptive student is a threat. But in a growth mindset, those students are challenges; they're opportunities to hone their skills, increase understanding, and become a better teacher.

In fact, some teachers tell their students, "Every time you make a mistake, become confused, or struggle, you make me a better teacher." These students go home and boast to their parents,

"I really helped my teacher today!" Teachers with growth mindset might set and publicly share teaching goals, reframe deficits as opportunities for growth, ask others for better strategies, seek mentorship, avoid language that implies a fixed mindset about their own abilities, share their own mistakes with students, and vocally embrace it as a chance to get better.

2.2 Why Game based Assessments?

Game-based assessments offer a powerful, candidate-friendly alternative to traditional testing. Game built as games to assess candidates' skills in a quick and engaging experience. Game-based assessments are flexible and can be administered on a standalone basis and are perfectly suited for measuring the critical cognitive skills. Games can be adapted to accurately and reliably measure cognitive abilities, as well as job-relevant personality traits. Games for your brain are a fun way of challenging yourself mentally. Regular training with brain games will keep your brain at its highest level and boost your cognitive performance to its maximum.

2.3 Psychometric Tests

Psychometric tests are a standard and scientific method used to measure individuals' mental capabilities and behavioral style. Psychometric tests are designed to measure candidates' suitability for a role based on the required personality characteristics and aptitude (or cognitive abilities). They identify the extent to which candidates' personality and cognitive abilities match those required to perform the role. The information collected from the psychometric test is used to identify the hidden aspects of candidates that are difficult to extract from a face-to-face interview.

Game-based assessments can accurately evaluate identify the following favorable traits for a teacher:

- **Fluid Intelligence**

  Fluid intelligence is the ability to solve new problems and adapt to unfamiliar situations. In short, fluid intelligence predicts job performance better than any other ability, personality trait, or skill.

- **Working Memory**

  Learning processes are underpinned by a specific component of fluid intelligence, which is working memory, or the ability to assimilate and manipulate new information. Learning and professional development potential is dependent upon the integration of new information and so-called crystallized (previously acquired) knowledge. Quickly forming these connections results in an increased ability to apply newly acquired methods or processes to different contexts or situations.

- **Problem-Solving**

  Problem-solvers—people who are able to independently identify and systematically apply the most appropriate solutions to new and complex problems. Sticking with established ways of doing things is no longer sufficient in today's increasingly competitive and dynamic landscape.

- **Creativity**

  Intelligence and creativity are intricately linked—intelligent individuals are able to come up with multiple distinct, yet effective solutions to an unfamiliar problem.

- **Learning**

  This is a broad category that incorporates knowledge of the cognitive, social and emotional development of learners. It includes an understanding of how students learn at a given developmental level; how learning in a specific subject area typically progresses like learning progressions or trajectories; awareness that learners have individual needs and abilities; and an understanding that instruction should be tailored to meet each learner's needs.

LITERATURE REVIEW

After studying various psychometric evaluations being used in leading companies, we decided to develop some psychometric games in consultation with psychologists. The performance of the user in these games and the data collected when the user is playing the games (e.g. response time, score, timings of activities etc.) is analyzed to quantify the various traits if the user. The

games are small in size, the gameplay taking a few minutes in a typical one. Every game is made with the purpose of evaluating a set of traits of the user.

The user doesn't have the knowledge of the traits being measured (or even if they are being measured). The only objective for the player is to play the game to the best of his ability in the time frame given to him/her.

3.1 The traits that have been identified for teachers are:

- **Experiment and innovate**
    - ATTRIBUTE: **RISK**
- **Be flexible**
    - ATTRIBUTE: **FLEXIBILTY**
- **Truly Listen**
    - ATTRIBUTE: **OPEN MINDEDNESS**
- **Reflection**
    - ATTRIBUTE: **RESPONSE AND THOUGHT PROCESS**
- **A Growth Mindset**
    - ATTRIBUTE: **ADAPTABILITY**
- **Asking Questions**
    - ATTRIBUTE: **CURIOSITY**
- **Learning new Technology**
    - ATTRIBUTE: **UNDERSTANDING**
- **Analyzing Capability**
    - ATTRIBUTE: **CRITICAL THINKING**
- **Taking Charge**
    - ATTRIBUTE: **LEADERSHIP**

The games have been developed using ReactJS on the frontend, coupled with Redux to support animations. The games are state-driven, and the states are saved along with the times of various activities.

The back-end of the applications is based on the Django framework of Python. Django has been chosen because it is robust, with all batteries included. As it is based on Python, it works well with Machine Learning and comparative models that are currently planned to process the data.

Once the games are built, the next step is to get enough users to play them. The more users play them, it builds up the database and provides data on which we can use comparative models to process and provide results and recommendations.

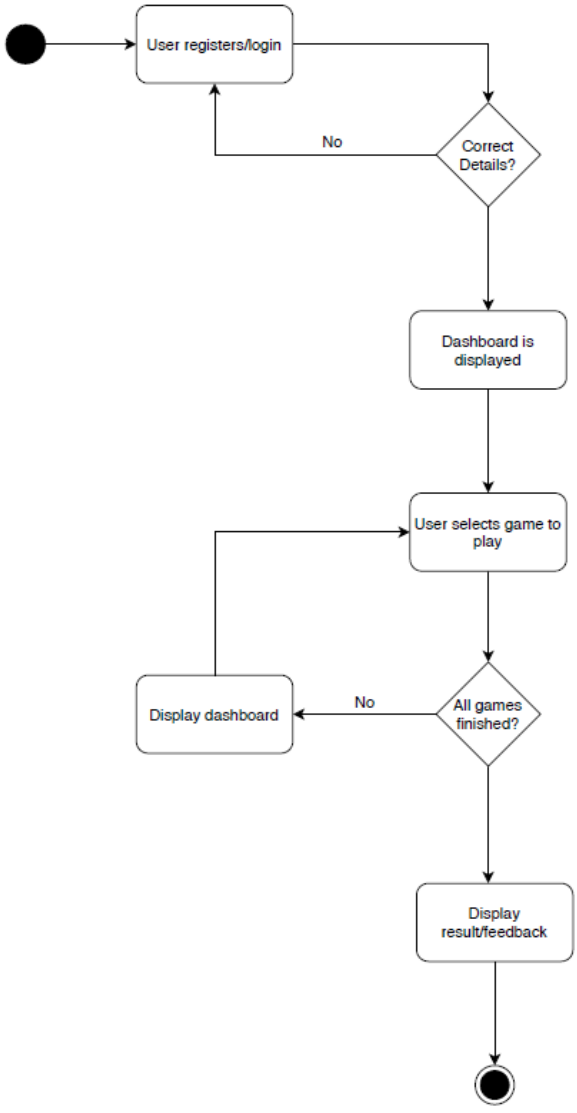


Figure 1: Activity Diagram

3.2 Problem Definition:

The objective of the Project is:

- To research literature and find out the traits that are favorable for teachers to possess.
- To devise small-sized games that can be used to test the traits obtained, in consultation with Psychologists.
- To build a comprehensive platform for the games to quantify favorable traits for teachers and generate trait reports for the same
- To perform analysis on the dataset thus obtained to detect patterns and suggest measures for improvement.

The dataset obtained can be analyzed to find correlations, patterns and clusters among the users. The results of the analysis can be provided to the user in the form of reports of his performance. Comparative analysis can also be done within the users, akin to fitness applications, wherein the performance of the users is compared within themselves.

3.3 Methodology:

The games have been developed using ReactJS and Redux are made with the motive that the user's performance in these games can be used to quantity the traits that these games are used to measure. This requires extensive review of literature to first find out what traits are favorable among teachers. The next step is to research and develop games for each trait, or a game that measures multiple traits. The development is done as a web application portal, into which the user can login and play the various games provided.

The games are played on the front-end and are made using ReactJS and Redux.

- The first constraint during development of games is that the games developed should actually require the traits that are being measured by it. This can be achieved by consulting with psychologists, to ensure that the games actually measure the traits they are designed to measure.
- The next stage, after the development of the games, is to get a critical mass of users to play the games. The comparative and ML models require data, and that is obtained by users playing the games

- To evaluate the performance of the users, one way is to establish thresholds in the data recorded, to quantify the performance on a scale.
- Another possible way is to have a comparative analysis within the user base, to compare the performances of the users among all the users playing the games. This approach is similar to that used by various fitness apps (e.g. Mi Fit) to provide analysis to the user.

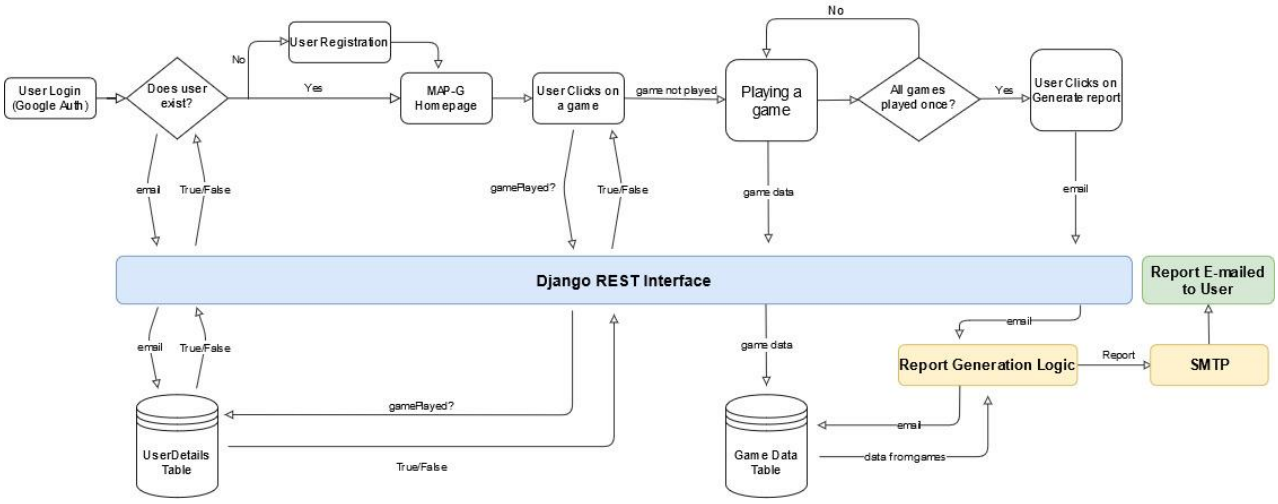


Figure 2: Methodology

Discussions

In consultation with a psychologist all these attributes of various games have been chosen.

After detailed discussions, various traits for evaluation of teachers the games which have been developed to measure and analyze the traits are as:

1) Personality reflection and face study- It is important that the teachers know about the mental state of students by looking at their face. Facial expressions have been great source of interested to Charles Darwin. What you see here is a series of illustrations of experiments done at this time, where volunteers had their faces shot so as to contort them into different expressions sort of to provide a science of the face. Darwin's view was that facial expressions were interesting in so far as they talked about the origin of the expressions in our evolutionary history, and the origin of the emotions that gave rise to the expressions. Why is it that anger gives us rise to one face and sadness another? How can we develop a theory of

this and relate it to the facial expressions of our neighbors like chimpanzees or even dogs. All of this presupposes a universality. For most people, their face is really their sense of identity, it's who you are, what marks you as, how you tell one person from another. It's probably the most personal or one of our personal parts of representations that we have. Not just because of the sensors. Although, clearly if your taste and smell and eat, and breath, that's awfully an important part of yourself, but yeah, behind the face is the brain and the face of course is the display system, the primary one for emotions. There are databases of facial expressions from all over the world.

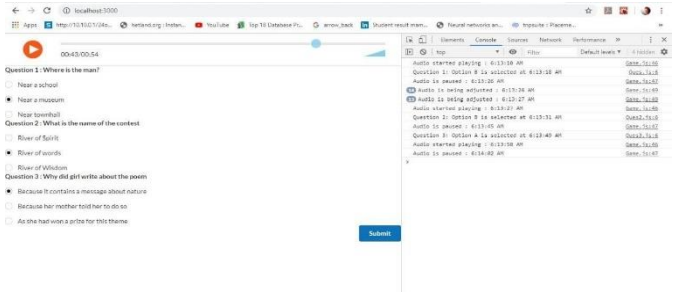
2) Learning Capability- It is important that the teachers learn themselves in order to make the students learn.

3) Risk- Important that the teachers take risk themselves in order to inspire students to take risk. It has been studied and observed that teachers also need to take some risks while teaching the same to the students. The most recent examples of teachers taking risks have been seen in the situation of 2020 Global pandemic-COVID-19. Universities were seen cancelling/postponing exams, coming out with different strategies to deal with various years of students. If the teachers are not ready to take risk, the life of students can not be put on the right paths, hence this parameter.

4) Listening & Understanding - It is important to know how well teachers listen and understand other's point of view.

RESULTS

COLLECTING DIFFERENT ATTRIBUTES OF EACH GAME

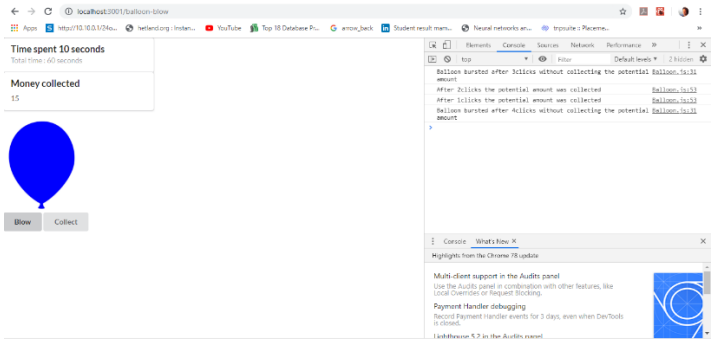


Attributes: Listening Game

Attributes collected for **Sharpness in Listening**:-

- Number of times start/stop of audio.
- Correct answer or not
- Number of times answer was changed
- When was the question answered

  Traits Measured: Critical Listening, Understanding Capability



Attributes: Blow the Balloon

Attributes collected for **Blow the Balloon**:-

- Number of clicks a balloon is blown to
- Balloon collected or burst
- Which kind of balloon is collected

  Traits Measured: Risk, Learning Capability

Attributes: Earn Maximum Game

Attributes collected for **Earn Maximum**:-

- Which Pile clicked
- A positive change or negative
- Total money collected

  Traits Measured : Risk , Behavioural analysis

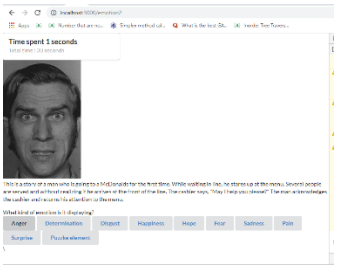


Figure 32: Attributes: Emotion Predictor Game

Attributes collected for **Emotion Predictor**:-

- Which emotion selected
- Time taken to choose the emotion

Traits Measured: Personality reflection, Face study

Report Generation and its Output

Report Output

Currently we are doing comparative analysis as suggesting a quantitative analysis for the same is not possible because traits of a person can not be measured and discussed upon quantitively.

Following the same lines, the data has been analysed using comparative models in Django. The results of the report are explained as:

1. In the earn Max game the player needs to collect maximum money in a limited time from 4 piles where the behaviour of each pile is different and a higher score indicates that the person is not only able to grasp the logic quickly but also aces problem solving capabilities nicely
2. The balloon bursting game is made with the purpose to collect max money before the balloon bursts as if it bursts then the money collected for that balloon would be zero. Each balloon exhibits a different behaviour but there is similarity in behaviour of balloons of one colour, so more is the score it indicates the person can understand and adapt to changing situations quickly.
3. Listening Game is a concentration test. The person needs to listen to an audio before answering certain questions related to it. The audio can be adjusted and paused as many times the user wants, but this audio adjustment pause gives an idea of how much time the user is taking for comprehending a basic audio and after that there are 3 questions to be answered which tells about the accuracy. If the audio is paused a lesser no of times with correct answers it indicates more attention.
4. Emotion Predictor Game The data of the emotion game is still under analysis and development as the game provides a series of ambiguous emotions and it can be analysed after getting some sufficient amount of data

CONCLUSION

MAP-G is a framework that adapts from psychometric tests and expands them to a sphere they are not currently being used in: to evaluate the mindset of teachers and candidates who aspire to be teachers someday.

It has the potential for a wide variety of Applications, like evaluating prospective candidates for teaching positions, mindset analysis of present teachers etc. It can also be incorporated into teacher feedback systems to better reflect the suitability of the teacher for the subject and for the general profession of teaching.

6.2 FUTURE SCOPE:

1. **Analysis of the data**

The current plan is to analyze the data on a comparative basis i.e., to compare the performance of the users among themselves. This is an effective technique, but requires a considerable number of users. It can be improved using ML techniques, to learn the correlation of various parameters about the user with his/her performance in the games.

2. **Expansion to mobile**

   The games can be extended (using ReactJS native) to work on mobile devices. It can possibly remove the bottleneck of users requiring laptops.

3. **Recommendations for improvement**

   Once the analysis engine is set up fully and user performances quantified, we can use the framework to provide recommendation to the users to improve their mindset and orient it towards teaching, which will be reflected in their scores when they play again.

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