Career World Explorer

a career finding game for junior explorers

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05438 Role of Technology in Learning

1. Abstract

We present Career World Explorer, an interactive game for students in eighth grade to gain exposure to nich career paths across different disciplines. Traditional career day events are limited to generic and well known careers, use the instructor or school's immediate personal connections as speakers for the students, and rely on text-based assessments. Career World Explorer uses role-playing mechanics, scaffolding through in-game mentorship and exposure to careers via "career worlds" to inspire and engage our target age group to see themselves in positions outside of the well-trodden paths of doctors, engineers and lawyers. We conducted multiple interviews with three eighth grade teachers to refine our educational goals, assessments and storyboard design. Our final prototype builds upon their feedback and the lessons learned from our iterative process.

2. Unmet need

Middle school students aren't properly exposed to a variety of career opportunities they could pursue in their bright futures. Traditional exposure to careers at this level is generally limited to 1) career day, 2) guidance counselors, and 3) non-interactive and nondescript job inventory assessments. These existing methods suffer from selection bias and only expose students to a handful of high-level career paths they could pursue. Research has identified middle school as a time when students can benefit the most from career exploration[1]. This is particularly important for 8th grade, before they enter high school, where they'll select electives that align with their interests and future career paths. Students may not take courses that could set them up for success in their future careers, due to a lack of exposure and knowledge regarding what the career/field entails.

The value of exposing young people, in particular at the middle school level, to potential career paths they could pursue is undervalued[2]. It may be thought that careers should be discussed at the high school level, but early exposure to potential career paths during middle school is invaluable[3]. Unfortunately, this is often overlooked in middle school due to a lack of instructor knowledge on the nuances of different careers, limited guest speakers in the class (career day), and a lack of guidance counselors for students to discuss their futures with. In particular, a lack of school counselors impairs career exploration in middle school and across the education pipeline. The national average for the ratio of counselors to students is 1:491, almost double that recommended by the American School Counselor Association[4]. Participating in career path exploration can lead to higher academic motivation, grades, employability skills, career self-efficacy and college aspirations for students[5].

3. Problem Statement

Our project addresses the following question: How can we better engage eighth grade students in career exploration?

We are targeting an audience that has not yet decided on prospective careers, specifically eighth grade students age 13 to 14 coming from low-income urban schools. Through our project, we hope to help students learn more about potential career paths and help younger students get exposed to possible vocations. By demonstrating to the students that they could belong in these different careers, they would become more motivated to learn and engage in the different aspects of the careers. The game would require computer knowledge from the students, and optionally peer mentors to connect the students to once they have gone through the game.

4. Learner Profile

We are targeting an audience that has not yet decided on prospective careers. Our target demographic is students age 13 to 14 coming from low-income urban schools, especially students with minimal exposure to extensive career-based events. The students would, in theory, know up to 7th grade educational content and have a basic understanding of their own interests and hobbies (interest in computers, interest in english, etc). Through our project, we hope to help students learn more about potential career paths and help younger students get ***exposed*** to possible vocations. By demonstrating to the students that they could *belong* in these different careers, they would become more motivated to learn and engage in the different aspects of the careers.

As our intended audience is upper middle school students, it is highly probable that they will have little to no knowledge of potential careers they are interested in. While our project does not intend to create a career roadmap for the student, it would help uncover a myriad possible fields that the students never had exposure to before, providing a spark of inspiration that they can in fact find careers they are passionate about.

Much of the project focuses on both avenues of motivation (intrinsic motivators, extrinsic motivators). Intrinsic motivation becomes apparent both when the learner enjoys playing games and if the learner desires to discover potential careers. Users motivated intrinsically are able to utilize the game to their own terms. Moreover, with proper facilitation, this game may also become a great substitute to “career days”, as remote learning and interaction becomes more and more prominent due to the pandemic.

Learner Background	What are the age (13-14), gender (any), location (low-income urban schools), ethnicity (any), language (any), disability (representation), level of education (8th grade)
Prior Experience	What prior knowledge, skills, experience will they have that is relevant? How will past experience influence their cognition and development? How can this experience be drawn out and integrated into the learning? Knowledge of 7th grade content, incorporating interests (school subjects, future career, outside-of-school interests) into our game.
Learners' Objectives	What do you think the learners' objectives will be for completing the program? Learn more about career paths and exposing younger students to possible vocations.
Learners' Motivation	What will make the program most relevant to the learners? What will prove meaningful, and provide motivation to learn? Showing students they belong in these different careers, having them actively learn and engage in different aspects of the careers (agency), gamified learning, giving inspiration to discover possible careers
Technology	Do the learners have access to learning technologies (e.g. computer, CD-ROM, Internet, video, etc.)? Are they predisposed to using these? Computer-based, they've used computer before
Support	What kinds of support will be needed (academic, peer, supervisor, technical, etc.) to help ensure learner success?

5. Competitive Analysis

We surveyed existing systems that focus on careers and job planning. We focused our survey on games that are targeted at younger audiences. Some games, particularly the popular entertainment game *Job Simulator*, were not so much interested in formally educating young students about careers as it was on creating an entertaining experience. Other systems, such as *Mari*, were more focused on formal education than game-based interaction, leading to a text-heavy system.

6. Deeper Problem Understanding and Expanded Learner Profile

To better gain a better understanding of both our student audience and the existing methods of career development in middle schools, we interviewed several 7th and 8th grade teachers. They provided us with key insights into what goes in the classroom for this topic, along with invaluable feedback on our current solution ideas. Before the interviews, we drafted our initial educational goals and assessments, for which we received feedback during the interview. The initial draft of the educational goals is not in this document (can be found here), but our refined educational goals and assessments can be found in section 8.

Here we provide the notes from each interview, and we bolded some of the key takeaways.

Interview 1 - Teaches 7-9th graders

A. I began by describing our project, covering the big picture, the need, the problems we perceive, and our initial proposed solution
    - Eighth grade don't do much career stuff, it's more a ninth grade thing
    - Junior highs don't necessarily have career days, more of a high school thing
    - The thing with grade 8 is that they're going through puberty, kids in eight grade at the start of the year aren't the same at the end. High school is less so, they're more focused
    - Revealing what is out there, outside of the obvious stuff, explaining what is out there, piquing their interest is really important. At that age they're not quite ready to think about their future beyond just exposure and excitement
    - If we can connect the careers to the classes they're currently in rather than just high school and college it would be more effective. If you tie it into only their grade 12 courses they won't care
        - Connect it to what they're learning now
    - **Telling kids "you'll need this when you grow up" isn't useful to kids. They need something that is current to their life**
        - **"These chemists use the chemistry you're learning now"**

B. We talk through each of the five goals we have from milestone 4, I ask for initial thoughts, how they'd change them, etc.
    - College courses (goal #5), is too far ahead
    - Exposing them to the stuff behind the generic career path is good. For example in education, it's more than just teachers that are part of the system but that's all they think it is.
    - **Piquing their interest**
    - If we can tie the system content with the curriculum, then they're able to see the connection between what they're learning

- Potentially consider multi-phase exposure, not just a one off in eight grade (do it at the beginning of the year and at the end of the year)

C. I present the storyboard sketch with a proposed solution, I ask how that might fit into the classroom, if it'd work with their students, how they might change it, etc.
    - Theme is great
    - Skill tree is great, being able to visualize their skill tree with the mentor's skill tree is a great way for them to see the roadmap
    - Make the mentor/superhero a real person. Would be cool to get a video of that person in that profession
        - In grade 8, some kids will be able to comprehend reading materials and some will not. Need to maximize the audio visual stuff. So they might have a ton of fun with the world, but they might get bored with the resources page
    - Having interaction, even silly ones, you'll keep the kids. Little silly tasks will keep students engage, reading paragraphs will lose students
    - Making a virtual reality with their character is a good idea with this age group
        - Makes it more fun and engaging for this age group
    - As long as the experience is focused on the end goal, and keeping the characters streamlined is key
    - Having worlds to go to will help facilitate fun conversations between peers
    - Consider focusing on the skillset tree than the task itself
    - Maybe have a complex task and then the subtasks are things the student can do
        - The superhero can guide them
    - If we focus on one world, and make it specific (e.g. each world is an individual career), will help with retention
        - So not just a chemistry world, maybe a fragrance chemist world. It would be more memorable for the kids
    - Should we have a questionnaire for each career world? Like for a doctor world, do another questionnaire to narrow it down more
        - Make a general survey, then a specific survey
        - Won't lose kids if it is an engaging interface
    - **The less thinking and reading kids need to do (especially at the start), the more engaged they'll be**
    - E.g. chemistry world, being able to see all the jobs in chemistry world is still beneficial
    - Video conference call with the mentor is too far, but a general set of questions that a mentor answers in a short video
        - Show them around a real lab, connect the fantasy with reality
        - Provide resources that the outgoing kids might use

Final Thoughts:
- Teacher would use this in class
- Kids in this age group aren't very resilient users, make it super clear
    a. No one likes reading paragraphs

- Should we use quizzes in between?
    b. At the end, with the final assessment, be careful with the interaction. Might need formative assessment to remember
- If we do reflections at the end, don't ask open ended questions
- **Consider printing a certificate to remind them of their experience**

Interview 2 - Teaches 7th grade in Baltimore, Maryland

- I began by describing our project, covering the big picture, the need, the problems we perceive, and our initial proposed solution
    c. Gifted and talented students in 7th grade (!!) do a career thing at the beginning of homeroom time
    d. Because of the population of the students (40% are multilingual/special-needs) so accessibility is important! Visual focus is super nice but having the features for voice narrative.
    e. Currently, the students choose whatever careers they want to look at, but the videos are "ancient" and the minigame they play are awful. A new tool like this, where the element of choice exists is super nice. Also Youtube is blocked at her school so they can't access those videos!
    f. At her school (Baltimore County Public Schools):
        i. Lesson 1: Medical/Science Careers
            1. Neurology
            2. Dentists
            3. Vets
            4. Biochemist
        ii. Lesson 2: Trade Professions
            1. Mechanic
            2. Barber
            3. Construction
            4. Entrepreneurship
        iii. Arts and Entertainment
            1. Producers
            2. Choreographer
            3. Tour Manager
            4. Graphic Designer
        iv. Education
            1. Teacher
            2. Dean of Students
            3. Training and Development Specialist
            4. School Counselor
        v. Business and Retail
            1. Cashier
            2. Sales Manager
            3. Buyer and Purchaser

vi. Financial Careers
    1. Accountant
    2. Bank Teller
    3. Financial Advisor
    4. Stockbroker (!!??)
vii. Hospitality Career
    1. Chefs
    2. Host/Hostess
    3. Chauffeur
    4. Tour Guide
viii. Engineering
    1. Architect
    2. Mechanical
    3. Computer Hardware
    4. Software Developer

- We talk through each of the five goals we have from milestone 4, I ask for initial thoughts, how they'd change them, etc.
    g. Goal 1
        i. Talking about disabilities and showing the students that a diverse group of people are able to become such and such careers (dyslexia, ADHD, autism, etc)
    h. Goal 2
        i. Which is… this! This is good!
    i. Goal 3
        i. Some careers are too projected to be one way and end up being something completely different (i.e. architect was math+art but SIKE it was just art). Unsure about this goal, there is too much nuance in seeing the connection between careers and educational assessment. It should explain why, not just state. (solving word problems in math can help the LSATs).
    j. Goal 4
        i. Awesome. Some (lower-income) students are thinking about jobs that pay well over jobs that they are interested in! Also, sometimes a job *is* just a job. But also maybe we should start preparing the students for what the world *is* or what it *should be* (thinking about capitalism)? I's hard...
    k. Goal 5
        i. Yeah. Awesome. Maybe with the added caveat "that, hey, this doesn't necessarily mean end all be all."

- I present the storyboard sketch with a proposed solution, I ask how that might fit into the classroom, if it'd work with their students, how they might change it, etc.
    l. **Emphasis soft skills as well as hard skills!**

Interview 3 - Teaches 8th grade in Atlanta, Georgia

- I began by describing our project, covering the big picture, the need, the problems we perceive, and our initial proposed solution
    m. Believes career day at their school is important and this type of CTE is particularly important to engage in at the students' age
    n. **They have a whole day devoted to "Career Day"**, students stay in their homeroom course and different people come in and out to present and share about their jobs
    o. Mostly done through spouses/children/relatives of the teachers, occasionally someone's parents they might know (if they're involved with the school)
    p. Sit and listen, sometimes the students get a handout, **they encourage the presentation to be hands on**, lots of question asking
    q. During the breaks between presenters or before/after lunch, the class will discuss what they've seen so far
    r. Overall students seem to enjoy the day and are engaged, although they don't "assess" it anyway, it's informal
    s. Believes a solution that holds the student attention would be key for this
    t. Exposure to more niche careers seems beneficial, if the student can retain it. **Since it might be totally new to them, will they be able to recall it in a week or when they are picking high school courses?**
        i. Maybe give them something to hold on to

- We talk through each of the five goals we have from milestone 4, I ask for initial thoughts, how they'd change them, etc.
    u. Goal 1
        i. Likes the breakdown of careers, focusing on less generic ones. Says this sometimes is the case with their career day, depending on who comes in
        ii. **If it's too specific though, the students might not know what it is or recall it, so we may need to frame it in the greater context (i.e. this is an engineer, here's a certain type of engineer that works on X)**
        iii. To also help with recall, **give them something tangible**
    v. Goal 2
        i. Representation is great, they try to do that in their school, but it's hard since they mostly use spouses and children
        ii. Having students seeing themselves in a career seems useful for them learning it and also feeling that they can do any career
    w. Goal 3
        i. Sounds like a great end-goal for the students
        ii. Can help them see the real connection
        iii. Might be difficult to implement though, since some courses might differ between high schools, like if a student doesn't go to the expected one

1. **Could keep it broad though**, “you should take electives/courses around life sciences” since students often have a choice on diving further into biology or chemistry, etc.

iv. Would keep it broad here, although not sure how easy it would be to break down a niche career into direct highschool courses

x. Goal 4
   i. **Students fill out something similar at the end of career day**, scantron they get a report on the following week, like a packet of “potential jobs” with not much more information
   ii. Thinks this is useful because students can search/Google for the jobs that are “best fitting” for them on interests
   iii. Afraid this might pigeon hole a student though or discourage them
   iv. Would student choice be better than narrowing for them based on interests/survey questions?

y. Goal 5
   i. Again, crafting a high school course path, specifically, could be hard, so perhaps keep this broad
   ii. Something tangible like this would be nice, like a printed handout custom for the student, something they can refer back to later
   iii. Paths might look different for two people ending up at the same job, could this be reflected? Or would this cause difficulty for the system we propose?

z. Any goals you would add/remove/change?
   i. Nothing comes to mind, just keeping it engaging and maybe giving the students something they can use to recall/search at home/etc.

- I present the storyboard sketch with a proposed solution, I ask how that might fit into the classroom, if it’d work with their students, how they might change it, etc.
   aa. An interactive and game solution sounds engaging to the students, a good approach
   bb. Computer lab time is possible at their school, but not sure if it could be applied to every school
   cc. Thinks the initial survey of interests should be brief, so students can dive in. **Is there a way they could change their world selection?**
   dd. Three worlds sounds appropriate, don’t want to overwhelm students
   ee. Obstacles in the real world, keeping them embedded, is a nice touch
   ff. **Skill trees could be overwhelming for students, do you want to show them what courses/interests could lead to this job?** Maybe list them
   gg. Game vs. interactive activity, thinks anything that has the students do something is better than just reading, they would like that
   hh. Questionnaire section good to see if they listened/learned, give them feedback or main points of the job
   ii. Mentor talk, don’t want it too text heavy for the students, they’ll likely skim it

jj. Resources → something a student could print out and take home?

7. Solution Overview

After exploring existing solutions, interviewing teachers and learning more about the problem domain, we refined out initial ideas into the overall solution goals of Career Explorer.

Focus on Niche Careers
Explore a greater breadth of careers to expose the students to career paths they can see themselves in.

Simple RPG
By creating a simple role playing game, with a character creation feature, the students are able to put themselves in the shoes of the in-game character and have agency in the experience. The use of skill trees commonly found in RPG mechanics was leveraged for the students to visualize their progress and also motivate them to spend more time in the game to grow their skills by exploring more career worlds.

Balanced Solution
We identified in our competitive analysis that other systems are too entertainment focused (e.g. Job Simulator) or text/quiz heavy (e.g. Mari). Career World Explorer affords a balanced environment, affording both engagement and education.

8. Educational goals, instruction, and assessment

Our interviews with the teachers elicited feedback on how to refine our educational pals, assessments and instruction. The following text defines our current goals, instruction and assessment structure of the system, with crossed out text and explanations provided to highlight the changes from our initial draft.

Existing curriculum standards for CTE (Career Technical Education)

- https://docs.google.com/spreadsheets/d/1BjJmSrB7FwS_TY-n3uBfP9vKN0ieCQQIrCVXrGjB6V0/edit#gid=0 (repository tab)

- https://highered.az.gov/az-middle-school-career-exploration-and-literacy-curriculum (basic goals we could adopt)
- https://cte.careertech.org/sites/default/files/files/resources/BroadeningPathFINAL.pdf (my personal favorite)
- http://marylandpublicschools.org/programs/Documents/CTE/mcar022008.pdf (while this resource is a bit dated, page 12+ has a really cool table we glean activities and goals from)

Goals

1. Teach students about the variety of career paths that exist within a broader category and are not usually discussed in the classroom. For example, doctors can be broken down into surgeons, dentists, optometrist, etc. and artists can be broken down into graphic designers, architects, illustrators, ux/ui designers, etc.

2. Allow the students to project themselves within any given career path (diversity of the field), and start instilling a “yes I can” mentality.'

3. Understand the relationship between educational achievement and career choices **based on what they’re learning now**, ~~demonstrating how applicable high school classes are in finding those careers.~~**We chose to refine this goal after discussing with the teachers. They emphasized the importance of linking the experience with what the students are learning right now in school. This also helps them visualize themselves in the careers we’re presenting to them, but the primary goal is to help them retain the knowledge by connecting the presented content with their eighth grade curriculum.**

4. Identify career clusters and related pathways through an interest assessment that match career and education goals (system level)

5. ~~Develop a career and education plan that includes a high school program of study~~ **After speaking with the teachers, we chose to eliminate this goal. All three teachers felt that it was too early for our target audience (eighth grade students) to start thinking about career planning.**

Assessments

Our discussions with the teachers revealed an opportunity to potentially turn the assessments and software experience into a year-long, as opposed to a week-long, activity. One of our teachers reasoned that eighth grade students change drastically as the school year progresses due to their age, and are often a different person at the end of the year compared to the start. While we agree with this reasoning, we were unsure if we should change our experience to be year-long, as our current focus is on exposure rather than outlining a complete pathway to a career from eighth grade to college. These conversations with the teachers have left us with much to think about, so we have not decided to change our assessment strategy to be a

multi-phase year-long approach. For now, we will continue with our current, week-long approach and will refine as we discuss more with the teachers.

Survey (G1, G2, G3)

- Pre/Post to measure disposition (embedded in the game system)

Daily Reflection (G1, G2, G4)

- Assess student gradual learning from their career exploration

"Final Project" (G2, G3, G4)

- The student writes a brief essay where students reflect on the career that resonated with them the most
- ~~Descriptive: Describe the next steps to help them get to that career (courses to take in high school, reach out to mentors in that career)~~ **We eliminated G5, and so the emphasis on next steps is no longer needed**

~~Projected High School Program (G3)~~

- ~~Logistical: Students plan/list what course(s) they might take in high school that would benefit their favorite career path(s) identified this week.~~

Connections to curriculum (G3) - **We added this assessment based on our refinements to G3**

- Assess students' understanding of the material by examining how well they connect the content with what they've learned in eighth grade. For example, if a student did a chemistry career, then the assessment would test their knowledge of what chemistry concepts from class were used by the expert chemist from our product

<u>Instruction</u>

1. Introduce facts on all the careers via video
    a. Highlight that there are so many careers out there that are less known
2. Students are matched with careers ~~"job shadow"~~ explore - **de-emphasizing job shadowing**
    a. Describe the tasks in a day for that job via a mentor
    b. Student executes on these tasks (interactive game side of it)
3. ~~Explain how you get to this career~~ **remove emphasis on comprehensive career planning**
    ~~a. Hobbies or interests~~
    ~~b. High school courses~~
    ~~c. College (if needed)~~
    ~~d. Prior jobs and experience~~
4. Show the students a video of the mentor from the game in real-life in their real context
    a. Connect the experience to real-world situations **Per teacher feedback, this shows the students that what they just experienced is actually a real-life**

job, but it's presented as a short video so as not to cognitively overload them with information

5. Give students access to mentorship and career resources **We chose to move this step from the main instruction to a form of "Extra content" that really eager students can access. Our teachers showed us that there might be some complexities with explaining in detail the career path that leads to a job, as well as that eighth grade students are not interested in direct career mentorship at this stage in their education.**
    a. Teach students to develop a plan to pursue a career

9. Design and Storyboards

We created a number of prototypes throughout the project. We started with low-fidelity sketch prototypes, from which the "career world", narrative and skill tree concepts emerged, followed by multiple storyboards to refine the interaction.

10. Learning Principles Description

We derived the following learning principles from this Storyboard:

1. *Login*: N/A
    a. The first pane in the storyboard involves students logging in, we show this to demonstrate our game is digital, no learning science principles are necessarily targeted here, but we will take advantage of the digital affordances offered by a computer.

2. *Create Avatar*: Personalization
    a. Past research[6,7] has shown that avatar creation in a digital environment can enhance student engagement and thus lead to greater learning gains. We incorporate a basic level of avatar creation in our game, allowing students to modify their skin tone, hair color, and a few other features. This was not only inspired by research we came across, but from our interview findings where instructors indicated their students love the game Among Us, that allows for similar basic avatar customization. Moreover, we provided additional customization (e.g. wheelchairs) that creates an accessible environment within the game.

3. *Interests + Topics*: Personalization, Motivation
    a. Based on existing systems for career exploration targeted at the middle school level, we designed a similar interest inventory assessment to customize the worlds students would be presented with based on their choices. The results of this brief survey allow us to personalize the game for the student and has the

student feel that their input matters. The adaptive and personalized instruction that follows in the game, based on the results of this assessment, can lead to improved learning outcomes[8].

4. *Intro To World*: Student Agency
    a. Based on the previous assessment, our system recommends three worlds students can explore that are inline with their interests. We also allowed students to pick from *any* of the worlds if they did not like the three our system recommends. This is inline with research around student agency, as past research has shown that allowing students to choose from a set of concepts leads to increased motivation[9].

5. In The World…: Student Agency, Gamified-based Learning
    a. Once in the world, students get to choose which individual to help out first, based on their location and surrounding environment. This gives students the choice and can make them feel that they have a greater impact on the outcome of the game. Even if it may seem minor, such as choosing to help one NPC over another, research has shown that small decisions like this can greatly enhance student engagement in a game-based learning environment[10].

6. Quest (NPC Interaction): Mentorship, Scaffolding
    a. During this interactive portion of the game, students are learning about the problem the NPC needs help tackling. Here we structure the dialogue in a way that provides scaffolding to the learner, making no assumptions about their prior knowledge. Any domain jargon used here will be colored and underlined, so the student can hover their cursor over it to get a clearer definition of the term. This was informed by past research conducted in a middle school science course, that reports providing clear definitions based on prior knowledge lead to greater student improvement[11]. We also created this interaction in a way that the NPC serves as a mentoring figure to the student, helping them with the task at hand and providing them with the instruction and assessment elements. Providing students with a virtual mentor figure helps them to process the presented information at a deeper level[12].

7. Interactive “Skill Check”: Engagement, Scaffolding, Game-based Learning
    a. This is the main interactive portion of the game, where students complete a small task, such as dragging-and-dropping pieces of playground equipment into the correct space. Even though it seems minor, several interviewees reported that this type of interactivity would be well perceived by their 8th grade students. Additionally, game-based learning research has shown that even when the interactive/game element is small, students at this cognitive level can be fully engaged by it[13]. Additionally, we will be sure to present this in a way that is scaffolded, such as highlighting the given pieces and spaces if students make

several mistakes in succession.

8. *NPC Thanks + Explanation*: Multimedia Principles of Learning
    a. This provides students with a summary of the task they just completed, along with how it directly relates to the given career in the real world. While multimedia principles of learning are scattered through the game thus far, we pay particular attention to them here. For instance, we'll ensure the words are brief and in close proximity to the pictures (multimedia, contiguity, temporal), the NPC will verbally dictate this explanation as well (modality), and this text will be in a friendly mentoring tone (personalization)[14].

9. *Video (IRL)*: Real-world Examples, Teaching for Transfer
    a. After the NPC explanation, we provide students with a real-world short (15-30 second) video showing some of the tasks this career does on a daily basis. Providing students with real-world examples helps them not only gain an understanding of what the career does, but also helps them to connect these concepts to existing knowledge they might have[15]. This deeper understanding and glimpse of a real-world scenario can help to transfer the task the student just did and the explanation they received to what actually goes on. The brief video format is also crucial for maintaining student attention at this level (8th grade students surrounded by their peers).

10. *Rate Career*: Metacognitive
    a. Here students will rate the career they just learned about, as well as filling out one or two high-level questions assessing their understanding of it. We will use these ratings to inform where we might need to make changes to the system, as well as for making recommendations to the student. While there's some challenges with using student ratings, research has shown that it can be used to help tailor instruction and make refinements[16].

11. *Reflection*: Metacognitive, Assessment
    a. This is a summative assessment students complete at the end of each day's use of the system. It will be used to see how much the students learned from the careers they were exposed to, as well as getting their general feedback on what they enjoyed or did not from their time in the game. Prompting students to think about their learning and write reflection(s) on the tasks they just completed has been shown to foster a deeper understanding of the material[17]. We leverage this to not only get feedback on our system, but to also measure the student learning occurring in the game and hopefully increase it by having them work on this task.

11. Technology Prototype

We were not able to complete a horizontal prototype that demonstrates the interaction flow, however we did create the following high fidelity prototypes based on our latest storyboard.

12. Formative Assessment

At this point our solution had come a long way since we did our first round of interviews, back in the 'Deeper Problem Understanding' portion. After defining our storyboard and key features, we interviewed two middle school instructors that acted as proxies to their students, as we did not have access to eighth grade students. We showed them our refined technology prototype and version two of the storyboard, along with a detailed script, to gain feedback on how engaging and intuitive our solution was.

Interview 4 - Teaches 7th-9th Grade Students

- She thinks it's cool!
- The character creator is like Among Us, which is apparently all the rage these days with eighth graders
    - She said she did an activity with them earlier this week where they could choose their avatars and they looked like Among Us characters and they loved it
    - It's a silly little thing, but it hooks them really well
- The person in the wheelchair is relatable, it helps them feel like they're in the game
- Seeing this latest storyboard, she felt the superhero narrative stuff is no longer necessary
- She's not sure about the career rating panel - what are they rating exactly? How much they liked the career or the world or what?
- **She suggested this cool idea of combining the rate your career with panel 11/doing a spectrum based assessment. This assessment can then be used to calibrate the next career world they choose in the game. This forms a game loop of sorts where students choose a game world and then try another that was chosen based on their career assessment**
    - Based on their answers, we can point them in a new direction towards another world
    - Could be a whole different career or a similar one
    - "If you like this world, maybe you'll also like this one"
    - This way we can get some variety in careers per student, but also level the playing field if a student didn't like the first world they went to. If each student went to let's say three worlds, then they have a higher chance of liking at least one
    - If they're really into it, then they'll want to do it again
- She expressed concern that if we do an in-system career and an external assessment then it might be too much for the students and they'll lose interest

    - Essay might not be taken seriously
    - She suggested we change the essay to be a homework task that asks them to **explore** one of the careers they liked. If they liked the furniture world then they have to do research about that real career. This could work especially since the system is meant to grab their attention rather than go into any career in-depth
- Even though she originally suggested in her first interview that connecting the system to what they learn is a great idea, she sees now that connecting something like a furniture world directly to the curriculum can be hard
- She suggested we add a “grade” or level to the avatar, that way they can compare themselves to the expert
- Let them see their skill tree
    - She suggested an idea where the skill tree of the mentor is in the background when they’re speaking
    - Keep the tree simple, it might confuse eighth graders
    - Can even do a grid of badges or something rather than a skill tree, which works well with the initial idea of giving them printed certificates
- **She asked if we can integrate some social/interpersonal skills. If we’re not going to “teach” them about math or humanities, then we should try to teach them about the social skills (which many of them lack at this age) through this system**
    - Maybe make it a quest, like a conflict resolution thing

Interview 5 - Teaches 7th Grade Students

A summary of the key takeaway the interviewee provided after being presented with each slide in our storyboard can be found below.

1. 1 child per computer obviously makes sense here, good to track continual use.
    a. Integration with school, making accounts could be troublesome

2. Makes it feel like a game, good choice to limit so they don’t waste time
    a. Limit the time here

3. Clicking options, making this a few easy questions is good
    a. Don’t overwhelm them, keep it short and minimize text

4. Giving them tailored and a choice is great
    a. Would a blurb about each help students narrow their selection

5. Feels like a game, good choice here too
    a. Will they know what the red “!” mean, make sure it’s intuitive

6. Not a bad way to deliver instructions, another opportunity for inclusion in the NPC
    a. Don’t be too text heavy, let students dive in right away

7. Here too, make it intuitive, use colors not words

    a. Find the balance of engagement, but not something they'll spend forever on
        i. Don't want them purposefully failing to play a fun part

8. Overview of what they just did is good, hopefully a big learning moment
    a. Just like 6, keep it brief when possible. How will you avoid theme skipping?

9. Video can be a good way, hate reading
    a. Headphone requirement, short video, enough to digest

10. A good way to get interest
    a. Will the "funnest" games get the best ratings?

11. Good overall summary, see if it stuck
    a. How will you get honest answers?

13. Redesign

Based on the two interviewee's feedback we got from the formative assessment, we propose the following 10 key redesign recommendations for our final solution:

1. Create a "gameplay loop" where students choose a game world, play the game, complete an assessment, and then play another game world based on their assessment results
2. Create simple avatars with simple customization akin to Among Us
3. Add badges for students to collect as they experience more career worlds
4. Integrate interpersonal skill development in the game through the in-game mentors. This will teach students how a professional behaves and how "soft skills" are an essential element of any successful career
5. Further reduce the amount of text in the game, too many assessments and text can lose the students. Use colors instead of text whenever possible.
6. Remove career rating survey and replace it with a survey assessment. Rating a career is too vague.
7. Let the students enter the career tasks as soon as possible, reduce introduction time at the start of the game world
8. Ensure that the balance of entertainment and education is maintained in the career tasks.

We also refined our assessments based on the recent round of interviews. For the final version we have four main types of assessment, three of them being summative and one being formative. Below we present text describing these types of assessment, provide some rationale for how they'll contribute to our system and provide us feedback, and also a few example questions from each category.

Pre-test

- Prior to logging into the system, students will complete a brief 10 question pre-test.
    - This will be used to gauge the students' current interest in future careers, their desired career path, and the connection they believe is between their course work and future.

1. What is your dream job?
2. On a scale of 1 - 7, do you feel that the courses you're currently taking will help you in the future?
3. On a scale of 1 - 7, are you concerned about what job you might have when you grow up?
4. - 10. …

Formative Assessments

- After doing the activity/game part for a given career in the system, students will answer the following three questions.
    - We will use these questions to gauge student interest in this particular career, check if they understood the gist of what someone in this path does, and identify any areas of confusion they might have.

1. On a scale of 1 - 7, how interested are you in this career?
2. Which of the following statements summarizes what this career does: ...
3. What is one question you still have about what someone in this career does?

Summative Assessments

- When the student is done using the system for the day, they'll fill out an 8 question survey related to what they did and learned from their time in the system.
    - This assessment is intended to gauge the students' engagement with the system for the day and to measure if they learned anything from the career(s) they were exposed to for the day.

1. From these ## careers you explored today, which one was your favorite? Please explain what made it your favorite.
2. Which of the following statements best describes what career X does: …
3. Do you see yourself working in any of these careers that you explored today?
4. - 10. ...

Post-test

- Upon finishing the system (potentially spanning several days), students will complete a brief 10 question post-test that is a replication of the pre-test.
    - This will be used to measure how the students have changed, if at all, upon finishing their use of our system. Ideally we'd like their dispositions towards their

course work to improve, for them to see a connection to what they're learning now and their futures, and most importantly be aware of new and exciting careers they could pursue!

1. What is your dream job?
2. On a scale of 1 - 7, do you feel that the courses you're currently taking will help you in the future?
3. On a scale of 1 - 7, are you concerned about what job you might have when you grow up?
4. - 10. ….

14. Case for the Solution

The two phases of interviews conducted with teachers demonstrate that our system addresses a need in the education of eighth grade students. Our focus on exposure rather than depth, niche careers rather than universally known ones, and in-game interaction as opposed to text-based learning was extremely well received by the teachers as well. The teachers highlighted that eighth grade students are not particularly interested in creating ten-year career plans or reading too much text, yet because our system is tailored to the needs of eighth grade students, the teachers expressed interest in using our system in their classrooms to inspire them in pursuing the careers of their dreams.

Our final poster also provides a great summary of our solution!

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