Odysy: Integrating Narrative-Centered Learning and Experiential Career Exploration for Improved Career and Technical Education

Sakib Shahriar*, Ayesh Towheed, Jayroop Ramesh, Taha Ameen

Research Assistants

The American University of Sharjah [b,1*]

[a] *University City*
[b] *Sharjah, United Arab Emirates*

Abstract

The evolving job market has created lot of confusion and paranoia among students and job seekers. Traditional career education programs have failed to address the current market which is constantly evolving as a result of technological advancement with newer jobs replacing the traditional ones. Traditional programs have also failed to provide students with clear guidance in terms of making career decisions. Project-based approaches, including workshops and internships are resource consuming and inaccessible for most students. However, with the recent advances in Narrative-Centered Learning (NL), a novel form of career exploration provides a better alternative. This paper provides an overview of how NL can be utilized with modern technology to provide virtual experiential career explorations.

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* This is to indicate the corresponding author.
Email address: b00058710@aus.edu
URL: odysy-ai.web.app

1. Introduction

In recent years, there has been a rise in college dropouts and unemployment. This has caused uncertainty among students resulting in many students changing their majors during university. One of the major causes of this is the lack of career guidance for students. Graduates who manage to find employment often do not enjoy their occupation. This is mainly because of forced employment, whereby graduates opt for a particular career merely to survive rather than follow their personal interest. Overall, this has a negative impact on productivity and mental health.

To improve the career selection process of students, it is important to find new approaches that can be introduced to students. Traditional career education has failed to consider things such as personal interest in helping students select their career paths. For instance, most schools and universities often rely on aptitude tests, which are standard test to determine cognitive skills and trait of a student. However, this approach fails to consider the students personal interest. Students are often limited to few career selections due to lack of awareness in career exploration.

Traditional form of career exploration has relied on utilizing project-based learning. Examples include participating in a workshop related to a career, internships, and shadowing. While in theory this approach seems reasonable, it is highly resource consuming and impractical for more students. The financial implications of providing workshops and internships are unrealistic for most schools. For students who can afford them, they are limited by the number of internships they can pursue. Therefore, career exploration for most students are limited to a few careers.

With the advances of technology such as video gaming, artificial intelligence and virtual reality, there has been a growing interest in providing a new way of career exploration. In this paper, the authors review the improvements in Narrative-centered Learning (NL) and their impacts to propose a digital form of experiential career learning.

Following are the key contributions of this paper:

1) Summarizes the development of NL through technological advances and discusses the impacts of NL

2) Propose a novel approach in career exploration utilizing NL
3) Provides a discussion about the limitations and future research direction

Rest of the paper is organized as follows. A section containing historical development of NL and its impacts is provided next. This is followed by the implications of using NL in career education and presentation of digital experiential career exploration. The authors then highlight the challenges and proposes future research direction. The paper ends with a conclusion.

2. Narrative-Cantered Learning

Narrative-centered Learning (NL) can be utilized to provide interactive and personalized form of content to students. In contrast to the traditional form of content delivery which are static and methodical in nature, NL exploits the key aspects from both gaming and storytelling that naturally engages the human brain.

2.1 Utilizing video gaming technology and storytelling for NL

The dramatic growth of the video game industry, which generates 3 times more revenue than the film industry [1], has shifted the focus of researchers into utilizing video gaming concepts to student learning curriculums [2], [3]. The vast advancement in technology has enabled video game to reach an unprecedented level. Particularly, due to better computer hardware and graphics, video gaming has been more realistic and complete. Virtual Reality (VR) technology is set to become the next great tool in video gaming and earlier research have shown promising results in implementing VR in education [4], [5]. Similarly, storytelling is effective for content delivery because it engages the emotional side of the brain. Using narratives, the students can learn to connect different concepts easily. Stories also have a lasting impact and as a result helps the students to remember the concepts for long time. Unlike video gaming, academic research into storytelling for education is not new with research works dating back to as early as 1981 [6] and numerous works in the 90s showing the

positive impact of storytelling in classrooms [7]. Research in the field of storytelling for learning is still active with the term 'digital storytelling' finding its popularity. Digital storytelling utilizes computer program to combine various digital media including text, images, audio narration and video to convey a particular concept with the art of storytelling [8]. However, simply merging the two fields of work, i.e. gaming and storytelling, would not be complex enough to deliver educational content or experiences. Consequently, researchers have looked into implementing the narratives in a virtual learning environment by utilizing Narrative intelligence which enables a human or a computer to organize experience into narrative [9]. This approach often uses Narrative generation to dynamically generate stories that can be tailored to the user's taste and ability, providing almost an endless outcomes and possibilities. A multitude of research work have applied this approach of NL in various domain, including microbiology [10], mathematics [11], negotiation training [12] and language learning [13]. The following section will dive deeper into several of these works and highlight their impacts.

2.2 Impacts of using NL on cognitive ability and engagement

Although a vast amount of research work has been conducted in NL-based learning applications, it is important to understand the end result of such application. More specifically, it is essential to know whether or not the results influenced the student's learning outcomes and their attitude. This section will survey several works that utilized NL-based platforms, summarizing their approach and results. To study the impacts of NL on 8th grade students, [14] developed an game-based learning environment. Prior to playing the game, the students took a pretest. The game posed various problem-solving challenges to enhance their learning. Once they were done playing the game, they took another test. The comparison between the test scores show that students who scored higher during the pretest displayed greater engagement with the NL environment. Another interesting finding is that both gamers and non-gamers achieved improved learning outcomes. In [15], the authors developed a game-based learning platform named Engage to introduce computational thinking to middle

school students. The curriculum for the NL environment was developed around the Computer Science Principles course learning objectives for US middle school students. A popular Machine Learning (ML) algorithm known as Long Short-Term Memory Networks (LSTMs) was developed to assess the performance of the students. This method works better because it is more scalable unlike traditional methods which are built around hand-authored rules and statistical models. The results show that LSTM-based model outperformed the previous state-of-the-art approach in providing more accurate predictions of students' post-competencies. The work in [16] attempted to find the impacts of video gameplay on students' problem-solving skills. Undergraduate students were required to play either a roleplaying game or a brain-training game. The students were assessed on their problem-solving skills 20 minutes before and after playing the game using the Tower of Hanoi and the PISA problem solving tests. The authors concluded that there was no significant difference between the results of both the groups on either problem. In other words, playing video game did not enhance the students' problem-solving ability but at the same time did not diminish their ability according to this particular work. A literature survey between 2008 and 2018 of 20 studies have showed that 45% of the work concluded to positive relationship between engagement and learning using game-based applications whereas 20% showed mixed findings [17]. Another study of 273 trainees was conducted to find out if gamified content could enhance learning outcomes [18]. Several conclusions were made, including the fact that gamified content was more satisfactory to the subjects compared to plain content, although they did not find any significant change in declarative knowledge (i.e. facts). The interesting conclusion was that the non-gaming group performed better at procedural knowledge (i.e. specific skill or task). This means that although gamified content improved interest of people but at some cost of effectiveness. A game-based learning environment was developed in [19] for students to share what they have learned during the game-playing process and the impacts of such an application on elementary school students was studied. The framework shown in Figure 1 was tested on students using pre and post-test analysis. Besides improving the learning attitudes and motivation of students, it also enhanced their learning achievement and self-belief that can be credited to the knowledge organizing and sharing facility of the gaming environment.

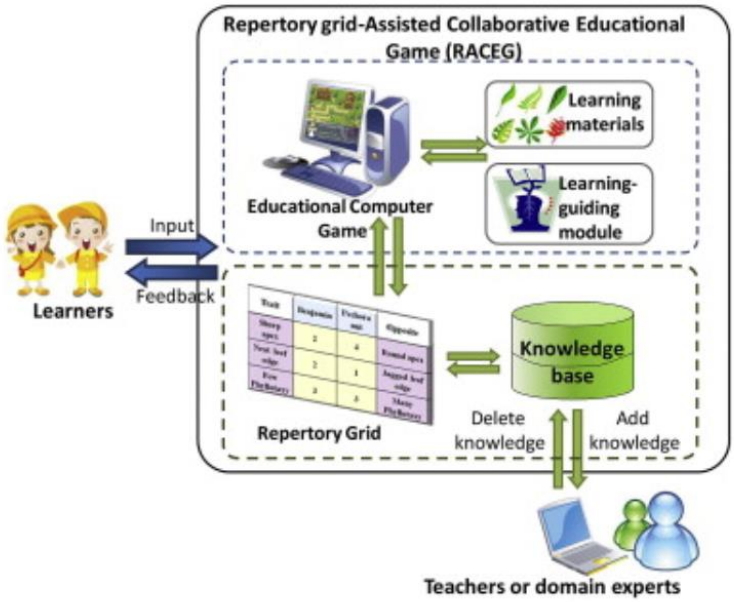

Figure 1 Proposed game-based learning environment in [19]

The research works discussed previously shows mixed conclusions when it comes to the effectiveness of NL and gamified environments. However, one thing was apparent, i.e. gamified NL environments did engage the subjects better. As mentioned earlier, research in this field is active and is showing promising signs. Table 1 summarizes the work reviewed so far along with few additional sources to highlight the impacts of NL and gamified environments.

Source	Domain	Approach	Results
[2]	Gaming impact on undergraduate students' cognitive and non-cognitive skills	Problem solving, spatial skill, and persistence was tested after 8 hours of gameplay	One game improved problem solving and spatial skills whereas the other improved persistence (non-

			cognitive)
[3]	Study impact of learner's motivation and problem-solving skills during game-based learning. Study conducted on rural high school in US	The change between pretest and the posttest was studied to draw conclusion	Depending on the game design, it can have positive or negative impact on learner engagement and also the game design itself can impact learners' self-efficacy and perceived competence
[4]	Explore 10th-grade students' perceptions and presences in a VR-based learning environment	The participants were asked to complete a pretest questionnaire. Then they were engaged in two lessons, one using immersive VR, and the other using an overhead projector, with both lessons being taught by the same teacher. Then the participants from two classes were asked to answer a questionnaire (posttest) to analyze differences in learning experience.	Perception of the teaching equipment and the classroom, social presence, teaching presence was enhanced by VR. Positive impact on the interest, attention, and interaction of learners using VR. No significant difference or transferring well-structured knowledge but for transferring ill-structured knowledge, VR is more effective than traditional media.
[11]	Investigate the impacts of gamified	The problems are presented as adventures scenarios, requiring	Results show that the group of students who played the game most

	application on elementary school students' mathematics skills	student to solve a math problem to advance to the next one. Pre and post written test was taken to study differences.	increased in their written test scores. It was also noted that the students demonstrated increased enthusiasm towards solving mathematical problems.
[12]	Develop a game-based simulation and tutoring system to enhance negotiation skills. Initial version was tested on US Army soldiers.	Evaluation using a Situational Judgment Test (SJT) administered to students pre and post-training. The answer pattern of subjects can then be compared with the expert answers to judge 'correctness'.	If a subject had prior bilateral negotiation experience in another culture, their pre-training SJT scores were higher and vice versa. Subjects that did not have prior experience, had statistically significant increase in post scores whereas there was no significant change for those with experience.
[14]	Study impact of narrative game-based learning on 8th grade students	Prior to playing the game, the students took a pretest. The game posed various problem-solving challenges to enhance their learning. Once they were done playing the game, they took another test	Results show that students who scored higher during the pretest displayed greater engagement with the game-based NL environment. Another interesting finding is that both gamers and non-gamers achieved improved learning

			outcomes
[15]	Develop a game-based learning platform to introduce computational thinking to middle school students	LSTM algorithm was developed to assess the performance of the students. The proposed algorithm is more scalable unlike traditional methods which are built around hand-authored rules and statistical models.	The results show that LSTM-based model outperformed the previous state-of-the-art approach in providing more accurate predictions of students' post-competencies
[16]	Investigate the impacts of video gameplay on undergraduate students' problem-solving skills	Subjects were required to play either a roleplaying game or a brain-training game. They were then assessed on their problem-solving skills 20 minutes before and after playing the game using problem solving tests	Playing video game did not enhance the students' problem-solving ability, but at the same time did not diminish their ability (no change)
[17]	Literature survey to discover relationship between engagement and learning using game-based	20 studies between 2008 and 2018 were investigated	45% of the work concluded to positive relationship, whereas 20% showed mixed findings

	platforms		
[18]	Find out if gamified content could enhance learning outcomes of trainees	Controlled experiment in which some trainees were presented with plain text whereas others were presented with game fiction enhancements.	Gamified content was more satisfactory to the subjects compared to plain content, although they did not find any significant change in declarative knowledge (i.e. facts). Non-gaming group performed better at procedural knowledge (i.e. specific skill or task).
[19]	Study the impacts of game-based application on elementary school students	Pretest and posttest were conducted to find out the differences between the test scores.	Besides improving the learning attitudes and motivation of students, it also enhanced their learning achievement and self-belief that can be credited to the knowledge organizing and sharing facility of the gaming environment.
[20]	Investigate the impact of virtual characters' empathetic behavior on high school students' presence in narrative-based	To measure the effect of empathetic characters on the dependent measure of presence, students were randomly assigned to either the control condition or the	For both middle and high schools, empathetic characters in narrative-centered learning environments had a significant effect on measurements of students' overall presence,

	environments	empathy condition. Pretest and posttest scores were considered.	involvement and control, naturalism of the experience, and resolution.

3. Implications to Career and Technical Education

Career and technical education (CTE) can be defined as 'an educational strategy for providing young people with the academic, technical, and employability skills and knowledge to pursue postsecondary training or higher education and enter a career field prepared for ongoing learning' [21]. Instead of educating students about a limited set of skills needed for entry-level jobs, CTE focuses on preparing students for a career. Study shows CTE programs to be effective in reducing dropout rates, providing certifications that are recognized by the industry, encouraging postsecondary education admission, and allowing students to earn dual enrollment credits [22]. According to [23], more than 70% of parents believed that CTE programs were beneficial in engaging students and were good for their child and more than 85% of business leaders believed CTE programs teach students transferrable skills that can benefit them in this economy. Despite the great benefits that CTE brings, there is an opportunity for technology to enhance the programs. According to [24], students as young as 11 years old are able to actively engage in career development process by using career exploration activities. However, using traditional CTE approaches, career exploration is limited project-based learning and engagement with industry professionals [25]. These approaches provide limited exposure to students due to practical and resource limitations. For instance, a student interested in a lot of different careers will probably fail to explore them all through traditional approaches. This is where latest technology, NL-based gamified learning in particular, can provide a groundbreaking career exploration platform. Using such an approach would not only allow students to explore all possible careers they are interested in, but also learn about the necessary skills associated with a career.

Technology has already been shown to be effective in career guidance. According to [26], 'computer-assisted career counseling, or career development activities that incorporate technology, appear to support retention and academic achievement.' A playable case study where students can act out a virtual internship and learn cybersecurity skills showed that using such experiential career exploration can allow students to make a better decision whether or not to pursue a career, understand the skills and trait needed for a career and increase their confidence to succeed in a specific career [27]. A comprehensive platform that can integrate the various career clusters [28] into a NL-based application has the potential to revolutionize career exploration and guidance. Therefore, we propose *Odysy*, a platform that can not only allow students to take their career odyssey to the next level, but also provide them with the opportunity to adapt to the evolving job market. State of the art Machine Learning and Artificial Intelligence tools like recommendation engine and neural networks can be used for career recommendation and simulation.

4. Limitations and Future Research

There are a few limitations that needs to be addressed to implement the proposed career exploration platform. Firstly, utilizing Machine Learning tools require data for the models to train on. Currently, there is a lack of organized datasets that can consider students' behaviour in career exploration tracks to provide accurate recommendations. This can be addressed by promoting the platform and integrating suitable ways for data collection. Moreover, integrating a large number of careers to explore can be time consuming in terms of developing narratives. This can be addressed either by utilizing narrative generation models similar to the one proposed in [10] or by crowdsourcing approach.

5. Conclusion

This paper provided a detailed discussion on the development of NL through digital storytelling and modern video gaming technology. The potential of NL was

highlighted through a survey of recent research and their impacts on cognitive ability and engagement. The authors proposed a digital experiential career exploration platform as an alternative to the traditional project-based career explorations. The key limitations including lack of data and scalability was highlighted and addressed for future research.

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