Using a Game-based Learning Environment to Develop the 4Cs

Anna S. Robberts
https://orcid.org/0000-0002-7047-5189
University of Pretoria, South Africa
ankie.robberts@up.ac.za

Linda van Ryneveld
https://orcid.org/0000-0002-9909-9949
University of Pretoria, South Africa
linda.vanRyneveld@up.ac.za

Abstract

It is becoming increasingly difficult to ignore the disparity between learning environments, the needs of students, and the expectations of the ever-evolving workplace in South Africa. This study investigated the influence of a game-based learning environment on the development of the 4Cs (communication, collaboration, creativity and critical thinking) that students need to be successful in their studies and subsequently in industry. The data for the study was collected by means of reflective essays that were written by 145 first-year engineering students only one month after the completion of the game-based activity. A focus group interview was conducted with six participants and it shed further light on the students' experiences. Their comments, harnessed by analysing their essays qualitatively, confirmed that a game-based learning environment provided opportunities to develop the 4Cs. Thus, the implementation of game-based learning environments in higher education should be further investigated.

Keywords: employability skills; game-based learning; learning environment; communication; collaboration; creativity; critical thinking skills

Introduction

The challenges currently faced by employers are demanding a change in the traditional pedagogically sound education approaches that have been in place for many decades. The emphasis is no longer only on the need for content knowledge, but increasingly also on specific skill sets that are required in the new era brought about by technological development. *New York Times* columnist and best-selling author Thomas Friedman (2006) talks about the "Flat world" where people are more connected globally than ever before. Interpersonal communication and connectedness are but two of the attributes needed to be successful in this scenario. Higher education institutions (HEIs), therefore,

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have to deliver graduates who are not only content specialists; they should also be able to navigate successfully through the ever-changing working environment.

Unfortunately, this is not always the case. The ManpowerGroup (2016) found that in surveys completed by employers globally, 40% of employers have trouble in finding suitable candidates for the positions that they advertise for their companies. Dismay regarding the ability of new graduates to cope in the workplace has been voiced publicly (Berr 2016; Wood 2018). Multiple sources claim that HEIs are not delivering critical thinkers (Arum and Roksa 2011; Erikson and Erikson 2018; McCarter 2019) even though it is said that the principal aim of undergraduate education is to teach students to think critically (Wyman 2018). It is also said that graduates lack "soft skills" such as emotional intelligence, complex reasoning, collaboration skills, and especially the ability to negotiate with other team members and to persuade them of an opinion (Wood 2018). In the context of the engineering profession, it is said that HEIs prepare their engineering graduates for the object world, and not for the social processes (such as discussion, negotiation, knowledge exchange, integration, and consensus-building) which form an integral part of the design phase of any project (Bucciarelli and Kuhn 2018).

The current study describes the transformation of an existing game, *The Amazing Race*, to a game-based activity that would suit an academic purpose in a higher education context. The game was adapted to serve as campus orientation for first-year engineering students and their first exposure to the development of the 4Cs (communication, collaboration, creativity and critical thinking skills) (P21 2015). The activity was based on the popular reality TV show with the same name, *The Amazing Race*©, that is broadcast by CBS, an American television network (*The Amazing Race*-CBS.com). Teams of two people participate in a race around the world for a grand prize of $1 million awarded to the first team to arrive at the "Pit Stop" in the final leg of the race. The teams travel to several continents by using different transportation modes to chase after clues on the activities to be completed in each leg of the race. The clues could either direct the teams to their next destinations or could be instructions for the completion of a task by one or both of the team members. These tasks, referred to as "Roadblocks", "Speed Bumps" and "Fast Forwards", are usually related to the location where the challenge is received. The teams strive to complete each leg ahead of the other teams to win a prize at the "Pit Stop" at the end of each leg of the race and to avoid elimination from the race. Only three teams remain to compete in the final leg of the race for the grand prize.

The existing game, *The Amazing Race*, was used to create a game-based activity not only to orientate first-year students of the extended engineering programme to the campus environment, but also to expose them to the skills needed to be successful as a student and as a future employee. The main objective of the current study was to evaluate the influence of a game-based learning environment on the development of the 4Cs in higher education students.

Context of the Study

The quest for HEIs to deliver graduates who are employable (Bridgstock 2009), compels these institutions to employ special measures (Chadha 2006), not only to bridge the gap between secondary school and higher education, but also to prioritise the development of the so-called "soft-skills" required by industry (Kruss 2002). Delivering employable graduates in South Africa is a formidable task when taking into account that the country is rated 146th out of 148 countries in terms of the educational system's quality (DHET 2013). The challenges within the educational system are further convoluted by socio-economic and historical factors (Kraak et al. 2013).

The high unemployment rate, even among graduates in South Africa, could also be the result of a mismatch between educational achievements and job requirements (Mncayi 2021). A higher education qualification no longer guarantees graduates a job – especially in South Africa where in 2019, skills mismatches of more than 50% were reported (Mncayi 2021).

The special characteristics of Generation-Z students also pose a number of challenges for the educational system (Giunta 2017; Jenkins 2015). Traditional classrooms are challenged (Duderstadt 2009) as the Generation-Z students need to be actively engaged and motivated before meaningful learning can take place (Figueroa-Flores 2016).

Game-based Learning Environments

Educators are not only facing ill-prepared Generation-Z students in a higher education context, but also have to deliver employable graduates who not only are experts in their subject matter, but who are also 21st century inclined. How could learning environments be designed to develop the expertise needed in these students?

Numerous researchers (Figueroa-Flores 2016; Garris, Ahlers and Driske 2002; Romero, Usart and Ott 2015) agree that a game-based learning environment would satisfy Generation-Z students' inclination to active learning environments. The game scenario also levels the educational playfield, an important factor especially when considering the diversity of the student cohort. All of the students, regardless of their level of preparedness, can participate without a feeling of inferiority, and benefit from the exposure to the game. Students can experience success just by being able to complete the activity and opportunities to develop their 4Cs could be incorporated together with the subject content. But, to what extent does a game-based learning environment provide the opportunity for the development of the 4Cs?

Methodology

Since the researchers wanted to understand the interplay of different elements in the learning environment, a qualitative interpretive stance (Merriam and Tisdell 2016) sufficed. This approach afforded them the opportunity to understand the phenomena through the meanings that all of the stakeholders assigned to them (Merriam and Tisdell

2016). As a cross-sectional case study (Merriam and Tisdell 2016), *The Amazing Race* was employed to look into the suitability of a game-based environment for developing 21st century skills in a higher education environment. The data garnered could shed light on the students' experiences of the activity and aid in the evaluation of the influence of the learning environment on the acquisition of the 4Cs.

The 4Cs acted as the conceptual framework that guided the study. The learning environment was designed to provide the students with opportunities to develop the skills that are highlighted by numerous bodies (P21 2015; DHET 2013; OECD 2005) as critical to be successful as a student, and as an employee in the workplace. As such, the 4Cs acted as the structuring principle in the data analysis and the discussions in the study.

Transformation of the Learning Environment

The aim of the learning environment was to habituate students to their new environment while providing an opportunity in which skills such as the 4Cs could be developed. For this particular environment, the existing game, *The Amazing Race*, could be adapted to a game-based activity that would fulfil this purpose. Destinations, befitted to the needs of first-year engineering students, were identified and three different routes by which the students in groups of two were to visit these destinations, were designed for logistical reasons. Different types of navigational clues were designed to stimulate critical thinking and problem solving, while simultaneously compelling the team members to interact and communicate with each other. At each of the destinations, the teams needed to complete a roadblock, another opportunity to develop the 4Cs, before receiving their next clue. The first team to arrive at the final destination, received the grand prize.

Sampling

All of the first-year engineering students [S] enrolled for the module ($n = 145$), together with the tutors [T] ($n = 5$), the lecturing team ($n = 3$) and an assistant lecturer [AL] acted as the sample of the study. Thus, the sampling method could be typified as being convenient (Salkind 2010) and purposive (Patton 2015). All of the participants gave written consent to the use of the data garnered with the instruments.

The students in the sample had different interests as demonstrated by the choice between the nine fields of study offered in the engineering faculty. The sample was also diverse in terms of gender (81% males and 19% females); age (between 17 and 20); and ethnicity that is clear from the 15 languages listed as mother tongue. The students originated from nine different provinces and the areas where they attended school varied between schools in the city (56%); schools situated in towns (28.6%); rural schools (3.6%); and schools in townships (10.7%).

Instruments

All of the students (n = 145) had to write a reflective essay [RE] after the activity since reflection reinforces learning, especially in competency-based modules (Berdrow and Evers 2011). By reflecting on their experiences, the students had to articulate the intuitive knowledge gained during the activities in which they were involved (Hatton and Smith 1994). In these REs, written only one month after they had participated in the learning environment, the students reflected on the learning experience by answering to the questions "What happened?", "So what?" and "Now what?" (Reed and Koliba 1995). These REs provided useful information regarding the students' experiences during the activity. The students had to complete two surveys in the first week of their studies at the university. In the first survey, the students had to provide background information, such as their province of origin; the type of area (city, rural) and school attended; and information regarding their age and more. This information could be used to provide demographic information regarding the sample (Collins, Joseph and Bielaczyc 2004) and could be used to interpret the set of circumstances (Kothari 2004). The second survey focused more on their computer use and how they would rate their own proficiency with regard to the use of different types of technology. A focus group interview [FGI] (n = 6) was conducted with the five tutors (T1 – T5) and the assistant lecturer (AL) involved in the module to gather more insight into the principles that constituted a successful game-based learning environment, and to gain further insight into the student experiences of a game-based learning environment. The FGI was recorded to be transcribed and analysed during the next phase of the research.

Data Analysis

The data analysis was done in different phases. Since the researchers wanted to investigate the influence of the game-based environment on the development of the 4Cs, all of the students' comments regarding the 4Cs were grouped together to look at their experience regarding their exposure to the 4Cs. Thereafter, to investigate whether they still experienced the environment as a game, the 12 characteristics of games as depicted by Prensky (2001) were used as organising principles. After integrating the data obtained by the two organising principles, it was compared with the data garnered from the FGI with the tutors and assistant lecturer to re-affirm the findings (Merriam and Tisdell 2016). At this stage, the data was evaluated, considering the interdependence of the whole and the parts, and comparing it with information gained during the review of the literature. By using this analysis method, the researchers opted to gain knowledge that could be beneficial to educators in other contexts as well (Lichtman 2013).

Discussion

The game-based activity, *The Amazing Race*, can be typified as a problem-oriented journey that accommodates inquiry-based learning in small teams where the lecturer only features as a guide and motivator (Knowles 1984). In the current study, by using a game setting, student engagement was ensured in a constructive learning environment

without the presence of any intimidating factors (Kirillova et al 2016). During the activity, apart from being habituated with their new environment, the students had the opportunity to work with a few of their counterparts; they met new students; and had to communicate effectively to be able to solve the clues and roadblocks provided to complete the race. During the design of the activity, special consideration was given to create opportunities to develop the 4Cs.

Communication

Knowledge is of no value if it is not shared, and especially in the workplace where teams of people with different expertise work together, the ability to communicate is imperative to demonstrate cognition (Jonasson, Strobel and Lee 2006). This is especially true for engineering students:

> I think the biggest issue is that the general stereotype of an engineering student, especially around campus, is that you know you're very introverted. I think that [the game] also helps them to get through that, because you know you have to speak to someone if you're lost. [FGI_T3]

During the activity, the team members had to stay together and complete the activities together. They had to decipher the clues provided in order to proceed to the next destination and had to overcome the roadblocks by finding solutions to the problems posed. One of the participants reflected as follows:

> We were trying to do it [the Amazing Race] as quick as possible, solve all the problems, get all your minds together and because of that with people that we didn't know in our groups, we got to communicate more on that basis. [FGI_T4]

The students needed to comprehend the instructions provided in written format and communicate orally using visual, mathematical and language skills to be able to unravel the clues and solve the challenges posed by the roadblocks in the race.

In the activity, any possible misconceptions of instructions or clues were not going to lead to detrimental outcomes. The students could revise their thinking patterns; use their communication skills to eliminate problems; or discuss possible solutions to challenges encountered. The students had to be able to convince their team members of their standpoints and needed the ability to listen to each other (one of the five communication skills (Morreale and Pearson 2008)) to proceed in the race. After the experience, one student realised that the problem of miscommunication in their team was that they were not open to each other's ideas. Unfortunately, they posited that the solution to the problem is a bigger team, and not that they should practise effective communication skills. One student wrote:

> … it took time because of some of the miscommunication we had. We both believed in our own knowledge and we did not come together in the beginning and infuse our

> knowledge to complete the race in the first place. The Amazing Race could have got a better score from myself if we were in a group of four. [RE_S109]

The students were offered the opportunity to practise different forms of communication, sometimes in the role of the person taking the lead and asking the questions and vice versa (Morreale and Pearson 2008) entailing unidirectional and bidirectional forms (Moreau 2003). Another student reflected:

> Working in a team was also a very rewarding experience. It improved my comprehension and communication skills. Giving instructions is always easy but receiving them is not always as easy. [RE_S91]

Levin-Goldberg (2012) says that if individuals do not possess befitting communication skills, the collaboration between them cannot realise. Many of the students linked the successful completion of the race to their teamwork and communication capabilities and even extrapolated the scenario to their future careers as professional engineers, where they would need different ways to explain their ideas to their co-workers (Darling and Dannels 2003). In the words of one student:

> Teamwork is one of the most significant points for both this Amazing Race, as well as the life as a qualified engineer, because you need a team to communicate with effectively in the field of work. [RE_S20]

Collaboration

The game-based activity was designed, amongst others, to serve as an ice-breaking activity where students were not only introduced to their new environment but also to their peers. The students worked in pairs creating a safe environment where every student had to take shared responsibility for the tasks. The fact that all of the teams had the same goal (finishing the race as soon as possible) provided students with the opportunity to mingle with others that were not yet familiar to them, thereby developing their social and emotional skills (Hromek and Roffey 2009). Students typically have a desire to connect with people (Oblinger, Oblinger and Lippincott 2005). One participant described it as a clubbing feeling:

> That was my favourite part of the Amazing Race …, because you got to group together, someone to look after you …, and it instantly has like this clubbing feeling. Like comradery of your equals in this race. [FGI_T5]

The team members did not necessarily know each other and they were most likely, being aspiring engineers, both people with strong ideas. Inevitably, they had to resolve conflict in the team, thereby practising how to contribute effectively to group dynamics to be able to complete the activity successfully (Bodnar et al. 2016; Hromek and Roffey 2009). The students' comments indicated the conflict experienced in the problem solving processes, as one student expressed it:

> Now that I reflect on the experience, I can see that my partner and I disagreed on a lot of the directions, as she struggled to understand the map and was doubtful of my directions. [RE_S53]

The students had the first-hand experience of the actions of their teammates in the activity and its influence on the success or failure whatsoever on the outcome of the race (Laal, Laal and Kermanshahi 2012). One student actually stated that they preferred working in a team and continued that they made good progress during the race because of certain character traits of the two team members. The scenario pointed the students to the importance of collaboration in the 21st century workplace (Dede 2010).

> Being in a team has always been my preferred approach to completing tasks and I enjoyed the company of my team member. I appreciated our alliance as he is not as lazy as I know my peers to be. His quiet nature allowed my charisma the light it needed to bloom and we made good progress in the race as a result. [RE_S21]

The students received constant feedback on their progress in the race, albeit from the fact that they have reached a new destination, or from the staff at the destinations or even their peers. In this way, they could try to improve their approach to the scenario and devise more effective ways to collaborate in their team, practicing these skills as proposed by Rotherham and Willingham (2009). One student remarked that:

> JPO110 increased my ability to work with other people. This event brought me closer through working with other people, and, trying by all means to cooperate with my mates in our group. I even learnt that through socializing and listening to others you can easily finish your task in a short period of time so group work was the best things that taught me how to cooperate as an engineer with others. [RE_S92]

Unfortunately, one of the students was subjected to the aggressive behaviour of their team member. Additional measures or even rules need to be put in place to limit the type of negative behaviour and to be in a position to use it to mentor the students involved. It became evident that collaborative and co-operative play depend on the ability of players to manage their feelings of frustration and delaying gratification (Hromek and Roffey 2009).

Another student mentioned that their team could not function effectively since they did not trust each other, a crucial element upon which an employee's collaborative success rest (AMA 2019). Another student commented that the activity taught them to trust and respect others, an attribute needed in the workplace that is highlighted by De Graaff and Kolmos (2003):

> I ended up picking a partner who I did not know at all which made the race interesting as we got to know each other and become friends. The fact that the race induces teamwork was interesting since I am not used to working in teams, however it teaches one to trust and respect others. [RE_S8]

The students had to be flexible and adaptable, they had to be willing to compromise and be able to work with different kinds of people to be able to complete the race successfully. Even though not prompted to elaborate on these elements of teamwork, students frequently commented on their participation in a team:

> Working in a group of two was a different experience as you don't really know the person that you have just met on campus, but it teaches you to adopt new ways of working in a team and you can learn how to compromise and work together as a team. [RE_S57]

Overall, it seems as if the existing learning environment, *The Amazing Race*, was successful in creating a game-based environment in which the students could not only experience the influence of effective team dynamics, but also practise collaborating with their peers:

> The Amazing Race was developed with the intentions of educating the learners in a lot of different ways. It helped the learners with navigations around the Campus and also played a big role in improving the ability of an individual to work in a team. That is, of course, one of the most important aspect of an engineer. [RE_S91]

Creativity

According to Azzam (2009), Sir Ken Robinson defines creativity as a process of looking for new ways of doing your everyday tasks; it is a function of everything you do albeit as a chef, a teacher or an engineer. In the 21st century especially, the new generation have to draw on their creativity to solve the numerous problems of this era. Highly creative scientists are impelled by curiosity; they cannot wait to find the answer to a problem (Amabile 1997). Nisula and Kianto (2016, 159) say "creativity and innovation benefit from experimentation and creative play with new ideas and ways of working".

The clues and roadblocks in the activity were consciously designed to enhance the students' creativity. The students were prompted with problems in different contexts, and as such, they had to think "outside the box" to generate unique solutions while exchanging ideas and building on each other's contributions. The roadblocks that the students had to complete demanded a variety of approaches to problem solving. In one of these, students had to find the arc length of the first row of seats. They had to take a new perspective and explore new pathways by applying techniques differently to be able to solve the problem, thus forcing them to be truly creative (Amabile 1997).

The activities forced students to consider numerous inputs while they were competing to the finish line, in this way enhancing the extent to which the student engages their expertise and creative thinking skills, and their perseverance to complete the task at hand (Amabile 1997). One participant commented that:

> Everyone came up with a different solution, so it is each person's creativity coming through and how they would solve that problem. [FGI_T3]

The changes in the ever-evolving workplace require employees that are continuously "updating" their knowledge and building new expertise (Thijssen, Van der Heijden and Rocco 2008). The roadblocks were specifically designed to evoke curiosity. The students were also prompted to provide possible reasons for the phenomena that they had explored:

> The science behind why the match lit up fascinated me. [RE_S5]

One of the roadblocks demonstrated the importance of following instructions, as the teams had to read all of the instructions before executing it. The last line instructed them to ignore the previous lines and proceed to the next destination. One student reacted positively to this tongue in the cheek attempt to create a relaxed environment to further creativity:

> … which was hilarious because the JPO 110 lecturer almost made my teammate dive in the pond. [RE_S7]

The students labelled the activity as being fun and said that it challenged their creative abilities:

> The roadblocks challenged us in a fun and creative way. It forced us to think outside of the box to solve the problems that we were faced with and interact with people around us. [RE_S19]

Critical Thinking

The nature of the problems that the students had to solve during the activity differed extensively. Apart from deciphering the clues to the destinations, the teams also had to complete a roadblock at each destination before they could proceed. The problems that they needed to solve were ill structured and vaguely defined with constraints that were not explicitly outlined, similar to those encountered in the workplace (Jonasson, Strobel and Lee 2006). The students were eager to solve the roadblocks and to find the correct solutions, in part because of the uncertainty of the influence of their actions toward the outcome of the game (Ozcelik, Cagiltay and Ozcelik 2013). One student commented:

> The roadblocks were my favourite part of the Amazing Race. Each roadblock we had to solve puzzles to get to the next clue, to progress in the Amazing Race. I found that very enjoyable, as I am someone who likes to solve problems. [RE_S7]

Rieber, Smith and Noah (1998) highlight that in order to play a game successfully, students have to solve problems with no obvious solutions. The problems which the teams had to overcome during the activity were unlike those that they would face in a traditional lecture hall setting. One of the participants stated that:

> It cannot be like by the book I have to do this, it's going to get you nowhere … what I mean, they need solutions that they never had to think of before. [FGI_T5]

For one of the roadblocks, some of the students had to calculate the surface area of a specific building on the campus, while others had to calculate the circumference of a circular platform, without using instruments to measure the dimensions needed. One of the participants pointed out:

> Critical thinking involves using your resources to surround you. [FGI_T4]

For the roadblocks, the students had to apply their prior trigonometry knowledge to the scenario at hand; find a frame of reference to use; consider different possibilities in the problem-solving process; present the scenario to the reader; and explain their reasoning in the problem-solving process. Their understanding of particular issues or phenomena had to be enriched and expanded by questioning their own understanding and scrutinising the understanding of other people (Savery and Duffy 2001). No standard approach could be followed to solve the problems that they encountered, calling on expert decision-making and metacognitive strategies (Dede 2010). By using these roadblocks, students were encouraged to use science and technology effectively and critically. By experiencing the dissonance of contradictory ideas, students really engage in critical thinking (Johnson and Johnson 1979). The students enjoyed being challenged, as indicated in the next response:

> We also calculated the size of the circle in the Piazza. We enjoyed this, because it was an activity that involved our logic and mathematics skills. [RE_S68]

Apart from using their own abilities and skills, the students also had to call on the expertise of their teammates (Jonasson, Strobel and Lee 2006). Damon (1984) points to the fact that through mitigating with their peers, the students are motivated to discard fallacies and search for better solutions:

> The roadblocks were good as they allowed us to find out more information about the university itself, things that you didn't know before. As a result, it did promote teamwork, as two brains is [sic] better than one when it comes to solving puzzles. [RE_S35]

The students were forced to make choices during the activity. Choices foreground decision-making skills and as such, could further learning (De Freitas 2006). Every action taken during the activity had a direct influence on the successful completion of the game. Since the relationship between the actions and the outcomes of the game were noticeable and the actions influenced the larger scheme of things, meaningful learning could take place (Tekinbas and Zimmerman 2003). The students could learn from their mistakes in a safe environment (McGonical 2011) as shown by the words of one student:

> We got roadblocks on our way before our final destination which needed to be critically interpreted and analysed. This led to effective communication. [RE_S11]

The students used words such as "thrilling twist" and "intrigued" to describe the activity. These words could indicate that the students experienced positive emotions that might encourage critical thinking and capacity to learn during the activity (Fredrickson and Joiner 2002). Positive emotions are also known to boost buoyant thinking that, in turn, inspires a creative approach to the solving of problems (Hromek and Roffey 2009). One student reflected:

> It had a thrilling twist in finding the locations due to the cryptic wording used in the clues. Another thing that intrigued me about the Amazing Race was the idea of roadblocks. [RE_S102]

The students had to collect, analyse, organise and critically evaluate information to find the next destination – a few of the characteristics of critical thinking that Fisher (2011) highlights in his discussion of Glaser's list of skills needed to be able to think critically. Dede (2010) also states that students have to develop an ability to assess which part of the flood of data is applicable to their problem, and after they have evaluated the data, have to be able to manage and integrate it into their existing databases.

The students could see science in action – they could learn the science phenomena by actually doing something and by the resulting quest to know why it happened (Moye, Dugger and Starkweather 2018). The students had the opportunity to revise their thinking patterns critically and creatively to double-check the answers that they generated (Facione 2011). As one student wrote:

> I remember at one of our stops we were supposed to sit on chairs, one with needles and the other with balls and write down on a piece of paper we were given, which one was comfortable. None of us wanted to sit on the chair with needles because we thought it painful and it turned out to be more comfortable. [RE_S107]

Another student summarised the experience in the following words:

> The Amazing Race event improved my thinking capacity together with my socializing skills. [RE_S92]

Conclusion

Even though the students were not prompted to comment on the opportunities afforded by the game-based learning environment to develop the 4Cs, almost all of the students' REs included a reference to these skills. From the discussion, it surfaced that the design of the learning environment provided many opportunities for the students to develop the 4Cs apart from the fact that it was beneficial for campus orientation. Above all, the students enjoyed the experience as can be seen from the average student rating of 6.3 out of 9 for the activity.

Surprisingly, the researchers also found that the students were awarded the opportunity to develop numerous other skills as well. Apart from applying time management

measures to ensure the successful completion of each activity, they also had to manage their group interaction to be able to find possible solutions to the problems faced within the time constraints of each session. In the final reporting stage of the project, the students had to organise and manage themselves to ensure that they completed a crossword puzzle related to the places they had visited and the activities they had completed during *The Amazing Race*, to win the race.

Students will not develop into desirable graduates by encountering one learning environment purposefully designed to promote the 4Cs, but if educators conscientiously design learning environments to equip students with these skills, they might be successful in delivering job-ready citizens and employees in the end.

Data Availability Statement

Some or all of the data, models, or codes that support the findings of the study are available from the corresponding author upon reasonable request.

Disclaimer

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