

INCORPORATING CONSTRUCTIVISTS LEARNING ENVIRONMENT WITH ROLE PLAYING ELEMENTS INTO 3D ANIMATION CLASSROOMS

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Abstract: The teacher-centered learning is one of the most common traditional teaching method, which has existed throughout every level in education system world-wide. This teaching practice had been keeping in line until now, and have been progressively enhanced by various teaching and learning technologies like the internet and learning management systems. However, how well or keen can the students learn from these teacher-centered learning, despite with the aid of learning and teaching technologies that are being granted to them? Regular university practical-based classes, like 3D animation, are mostly handled with the teacher-centered approach, especially during tutorial sessions with the students. Not more than half of the students might be able to retain what they absorb, while the remaining students suffer short-term memory retention. Constructivist teaching and learning approach is one of the learning theories that engages students to actively construct their knowledge, rather than receiving knowledge in a passive state. This study will focus on the implementation of a Constructivist Learning Environment (CLE) for 3D animation classrooms in UCSI University, Malaysia, with a suggested guide and framework. Rather than having a common CLE for the students to engage in, the learning environment itself is enhanced with Role Playing elements, to make it more interactively engaging, fun and interesting for the students to participate.

Keywords: Constructivist learning, Gamification, Problem-based learning, 3D Animation

Background

Practical or technical-based courses, like 3D animation classes, are typically conducted with the teacher-centred paradigm. Part of the constructivist ideology exists when it comes to accomplishing assignments and final projects in 3D animation. The constructivist theory kicks in when the students are working in a group, where they learn collaboratively to construct knowledge through the process of information sharing, negotiation and modification (Gunawardena, Love, & Abderson, 1997), during the process of producing a 3D animation output. Before the students initiate their final project, they must first learn about the fundamentals of 3D animation design. UCSI University's 3D animation student learn by undertaking 3D animation-based courses, before they dedicate themselves to create a final animation project. By then, students will be equipped with the appropriate knowledge, techniques and skill sets to generate concept arts, storyline, characters and effectively animate the final project with a 3D

authoring software. These final project is considered as a Project-Based Learning (PBL), in which students learn and utilise any necessary skills and knowledge to solve a problem which is presented to them. However, PBL is not only restricted to the final project itself, but to other final assignments in 3D animation courses, such as Character Animation and Advanced Dynamics. Exercises relating to each aspects of 3D animation are provided during tutorial sessions, but some students might not be able to retain what were covered from these sessions.

The primary mode of teaching in 3D animation courses are mainly tutorial-based. Firstly, the lecturer explains or elaborate on a concept of a 3D animation topic, followed by a demonstration, which consists of implementing techniques or step-by-step procedures to accomplish part of the weekly modules during each class. One of the major concerns that lecturers normally face would be the passive nature of the students during their tutorial sessions. Students would just sit, listen and follow what the lecturer demonstrates on the monitor. The lack of interest that are portrayed by several students, combine with slow learners who are unable to cope up with these tutorial sessions, are other factors that affect the students' performance in classes. Additionally, observations on practical-based classes revealed in between 40% to 50% of the students chose to distract themselves, with elements that were not part of the classrooms' teaching contents. The lab is equipped with Internet service, and the students would seize the opportunity to browse through numerous websites during lectures or tutorial sessions. With the availability of smartphones, students tend to focus their attention onto their smartphone's screen, rather than the projector or lecturer who is teaching during classes or tutorial sessions. Such conveniences that are portrayed by these elements mentioned above, serve as distraction factors to the students' learning, in which they might miss out important steps or technical terms that they might apply onto their assignments or final projects. At times, students are not able to answer the questions posed by the lecturer. Due to this teacher-centred learning approach, some students did not stand up for themselves and were meek or shy to enquire from their lecturer on certain issues pertaining to 3D animation. Some students were worried that their questions would be deemed ridiculous or not worthy to be answered by the lecturer.

Adoption of the Constructivist Learning Environment (Which will be henceforth be known as CLE) into a 3D animation classroom breaks the passiveness that are portrayed by the students, which turns them into active learners or participants in the classroom. Students will be actively involved in constructing weekly knowledge which are related to 3D animation design during and after class, rather than having the constructivist nature takes place near the end of the semester, especially when the students initiate their final projects. Students will have the opportunity to form learning groups, which enable them to collaborate or assist each other to construct knowledge together rather than constructing the knowledge alone. To initiate this research, a proper framework or guideline combined with a suitable online platform and facility is required. The adoption of David H. Jonassen's CLE model (Figure 1) will serve as the major guideline for this research. To make the class more engaging and interesting, Role-Playing elements are to be incorporated into each weekly learning modules. The Role-Playing elements are merely supporting components to the CLE, and to keep track of the students' weekly activities. Several goals or quests will be assigned to the students to complete, and in return, the students will be rewarded with experience points and achievement badges.

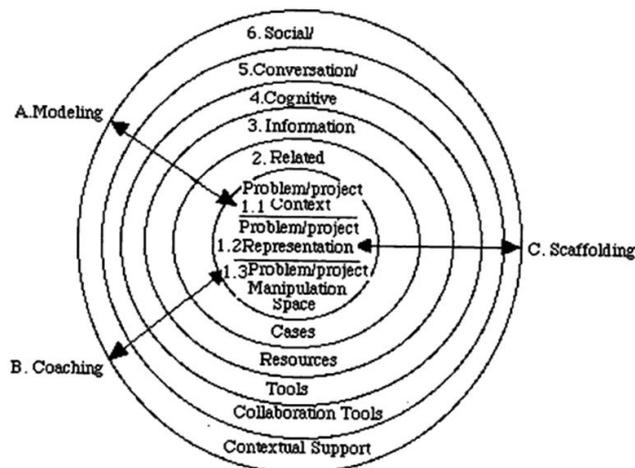


Figure 1 David H. Jonassen's model for designing CLEs.

Implementing the CLE into 3D animation classrooms may create different or various perspectives, experience or reactions from the students. But the result would be to observe whether the students who are studying technical

or practical courses, especially in 3D animation, are able to learn and construct knowledge effectively and efficiently within the CLE, compare to teacher-centred learning. When introducing the concept of CLE to the students, several Role-Playing elements are included, with the hope of attracting the students to actively participate in the learning environment; by collecting achievement points that will grant them additional bonus points in their course. With the appropriate setup, guide and the inclusion of the Role-Playing elements, like the introduction of Quest List, Rankings and Experience Points into their studies, the students might be motivated to accomplish their weekly tasks with their teammates. However, the structure of the CLE must be well designed, with crystal clear instructions, combined with suitable and related components and contents that are to be shared to the learners. By the end of the overall session, students will be interviewed and share their perspectives, thoughts and their experience after their engagement in the CLE.

Research Methodology

The theory of a CLE is where learners construct their knowledge socially, with the aid of their prior knowledge, or, with the interpretations of experiences in the real world, to achieve learning objectives that are given to them within the learning environment (Jonassen, 1999, p. 217; Wang, 2009, p. 2). To aid in their learning, the CLE is further reinforced with the aid of technological platforms, software or online accessibilities. Since prior knowledge is required to construct knowledge, it is not advisable to introduce this CLE to novice learners. Thus, 17 students who participated in this research are third year students, who had the basic and intermediate skills, and knowledge in 3D animation. The Character Animation course is specifically selected for this research. By the end of this course, students develop deep understanding and skills to animate 3D characters with real-life movements and body gestures, akin to human behaviour.

Throughout the entire CLE, the students are responsible in gathering knowledge, which are related to Character Animation, and apply what they obtained by accomplishing a set of weekly tasks. Each weekly session will be adopting Jonassen's CLE model, as a source of reference. The focus of the CLE is where learners are given questions, issues or problems, in which they will attempt to solve or resolve. Based on Jonassen's CLE theory, the problem drives the learning. Each of the weekly classes in Character Animation is designed to pose a specific Problem or Project for the students to solve.

Base on Figure 2, number 1 to 6 are the components that are required to design a CLE, accompanied by 3 supporting instructional strategies (Modeling, Coaching and Scaffolding). The details of the 6 components in the context of Character Animation are listed as follow: -

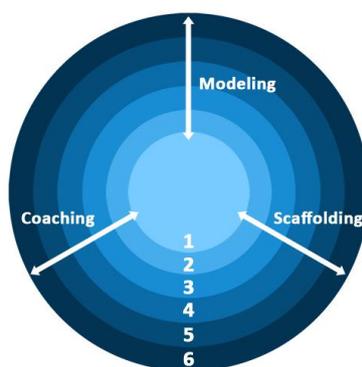


Figure 2 Adaption of David H. Jonassen's CLE model into the Character Animation classes.

1: Problem/Project

Problem/Project is divided into 3 sub-components, namely, Context, Representation and Manipulation Space. Context refers to establishing the problem as a real-life problem for the learners to solve. However, the problem

itself must be interesting, engaging and authentic as if it was in the real world, with the appropriate methods to solve it. This falls under the Representation sub-component. Manipulation Space refers to the suitable tools and environment for the learners to manipulate to solve a problem. Therefore, in the Character Animation classes, this component will serve as the weekly Problem/Project for the students to undertake, for example: -

- Week 02 Character Setup 01: Students are required to understand in setting up the joint structure in a 3D character, and apply the appropriate Inverse Kinematics (IK) handles onto those joints.
- Week 06 Character Expression 01: This class focuses on how to create character expressions, through Blend Shaping or placing individual joints onto the character's face.

Based on the given examples, the Problem/Project for Week 02 class focuses on creating and applying a suitable rig, by inserting a set of joints and IK handles onto a 3D character. Whereas for Week 06 class, the Problem/Project is creating a 3D character's facial expressions with Blend Shape.

2: Related Cases

This component refers to the prior knowledge or related experience that the students had, before committing themselves into the learning environment. Related case is an important component in the CLE, where the students require a form of understanding that is truly related or connected to the problem. Presenting the problem without any backstory prove to be a disadvantage to the students' learning, with much confusions that can arise from it. What the students require, are a set of related experiences that they can refer to, and that can assist them in solving the given problems (Jonassen, 1999, p. 223). In the Character Animation CLE, the related cases component is expressed with several demonstrations, explanations and lectures, that provide much understanding and information which are related to each of the weekly tasks. However, related cases are not only limited to the demonstrations that are to be performed by the lecturer, but, through provoking prior or past experiences of what the students studied in previous animation related courses.

3: Information Resources

This component refers to the necessary information that can help the students to comprehend and solve the cases which are presented to them. While investigating the problem, learners require information to build mental models and devise hypothesis that could be observed from the modifications that they apply onto the given problem (Jonassen, 1999, p. 225; Seng & Hung, 2003, p. 51). The World Wide Web itself houses an abundance of tutorials, references and study materials, which can be accessible instantly. For each weekly tasks, related information or links are provided within UCSI's Learning Management System (LMS) (Figure 3). Additionally, the students are also encouraged to seek related online information that are not included inside the LMS. Before the start of each sessions, the lecturer will narrate on the contents of each respective topics through a presentation slide, which is also available for the student to access and download from the LMS.

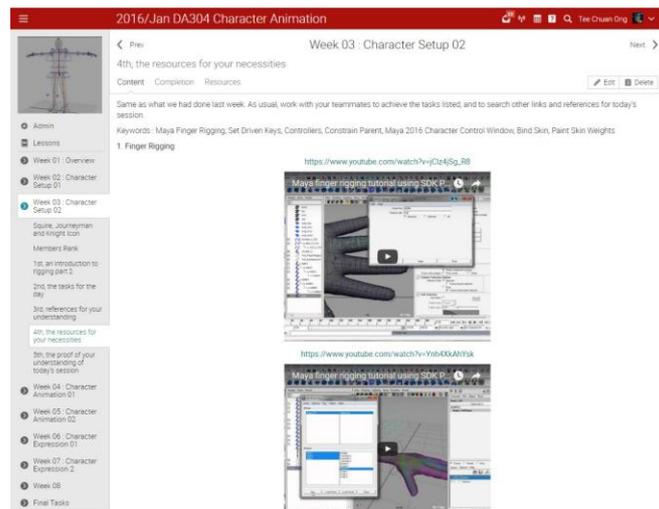


Figure 3 Example of an Information Resources in the Learning Management System.

4: Cognitive Tools

This component refers to appropriate computer tools to make cognitive learning easier, and to engage student with learning with technologies. In this learning environment, students utilize a 3D computer graphic software, namely Maya 2016, to perform, manipulate and solve each of the weekly tasks. Students will be fully dependent on Autodesk Maya to apply technical methods that they discover in the aspect of Character Animation, by manipulating and using the appropriate tools onto a 3D character model that is provided to them (Figure 4). By the end of each CLE sessions, the students are required to submit their Maya files, as proofs of their understanding of each Character Animation topics that are listed in their weekly tasks lists.

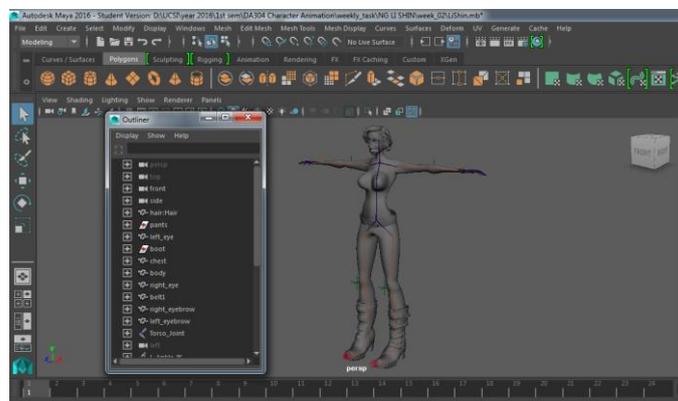


Figure 4 Students are given tasks to create a complete joint structure, and several Inverse Kinematics (IK) handles, onto a sample model provided.

5: Conversation/Collaborative Tools

Part of the CLE is the social learning aspect of the learners amongst each other, in which they seek each other for the solution to a problem (Wang, 2009, p.2; Wilson & Lowry, 2000). This component emphasizes on the collaborative learning of the students through a variety of communication tools. This practise is conducted through two selected online mediums; Facebook Group Page, and a discussion forum in the LMS. The Facebook Group Page serves as a community platform, where students ask questions and receive updates and notifications from the lecturer (Figure 5). Additionally, students make full use of the Facebook chat room service to communicate with each other and the lecturer, to discuss problems relating to Character Animation.

To encourage active participation, each team is required to take consecutive turns to post at least one question or topic, into the LMS forum page. When a topic is posted by a team in the forum, the rest of the students who are not associated with that team respond, by sharing inputs, methods, suggestions, opinions, reflections and their own personal thoughts towards that topic. From the forum itself, students not only expose to a known solution, but gain insights of different perspectives from their fellow course mates (Figure 6).



Figure 5 Example of a discussion in the Facebook Character Animation Group page.

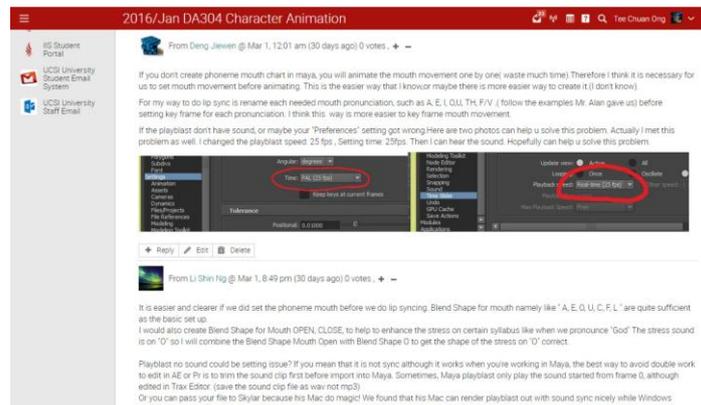


Figure 6 Discussions about lip syncing, and issue pertaining the lack of audio preview in Autodesk Maya.

6: Social/Contextual Support

To initiate the CLE into the Character Animation course, a physical environment must be appropriate and befitting, together with the availability of adequate equipment. To fit these criteria, the 3D animation lab (Figure 7) is chosen to conduct the CLE. The university's LMS is also included, to support the students' learning in the 3D animation lab. The lab consists a total of 21 computers, with each installed with Maya 2016, and design-related softwares. A projector is provided to display the demonstrations and weekly tasks that are needed to be done. The lab is further supported by the university's intranet system, which allows each student to gain access to the course's LMS, and online connectivity to the World Wide Web. The LMS serves as a platform that houses related study materials, practice files, discussion forums, and Dropbox page for the students to upload their Maya files.



Figure 7 Students engaging in the CLE, with the tasks list displayed on the projector.

Each weekly page in the LMS consists of several sub-pages, or sections, that are arranged in a step-by-step sequence (Figure 8), starting with the introduction of the topic, what are needed to be done (Tasks/Problem/Project and Related Case), the learning resources (Information Resources), and lastly, the submission of their Maya file into the LMS.

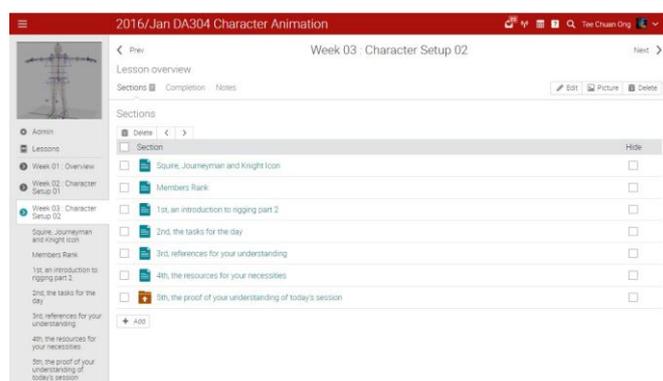


Figure 8 A sequence of instructions of Week 03's session in the LMS.

In the CLE, the lecturer shall act as the facilitator, by actively providing the 3 supporting instructional strategies, which are, Modeling, Coaching and Scaffolding.

Modeling

Modeling is the first step to perform in the CLE, where the facilitator demonstrates on how to solve a problem. This supporting strategy is essential, by giving the students examples on how to initiate and complete the weekly tasks from the facilitator's point of view. Giving the students with solely only the tasks and without demonstration will breed much confusion, together with the lack of understanding on the given topic. Worked examples or visual models relating to each of the topics may provide rich alternative representations to assist the students to perceive the structure of the given topics (Jonassen, 1999, p. 232). These visual models, in the aspect of Character Animation, consist of a fully rigged character model, or a 3D face model (Which are dubbed, Lecturer's Sample), are provided to the students, which can serve as references for their studies (Figure 9).

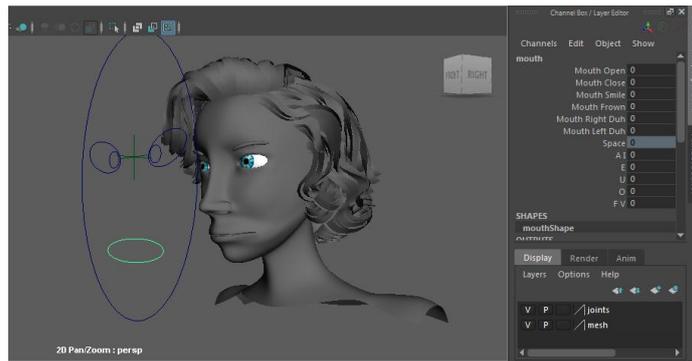


Figure 9 Sample 3D face rig with standard lips and phoneme controller.

Coaching

Coaching is where the facilitator provides feedbacks, advices, motivations and provoking reflections on what was learnt or covered. Problems ranging from technical difficulties, glitches, and on several occasions, missing out crucial steps, are common in 3D animation design, and these are unavoidable. Coaching is not only limited to face-to-face communication between the facilitator and the students in class, but can be offered through online mediums, like providing feedbacks and answers in a Facebook group post, or, giving advices or solutions to a student in Facebook chat.

Scaffolding

Scaffolding involves the facilitator supporting the learners with systemic approach in various dependable necessities. In the Character Animation classes, the facilitator plays the role of a scaffold to the learners, by providing an alternative assessment or tools to solve the problems. In the context of Character Animation, scaffolding can occur with the introduction of advance tools or methods for the students to explore and implement into their studies. Once the student is accustomed to the new tools, the facilitator will once again introduce another set of advance tools as an alternative method, in which the student will again explore and apply onto the very same task.

To further motivate students to accomplish each of these weekly tasks, experience points are awarded based on how well they perform in solving the problems that are presented to them. The experience points collected are converted and pooled into the students' academic points. Before that, the students are informed, and made aware of the importance of submitting their weekly tasks. The completion of these tasks contributes 20 points to their overall academic points. To further immerse the students into the CLE, the weekly tasks list is designed and designated as Quests List, akin to a common role-playing video or computer game. Students are awarded with experience points and ranks; that befit the experience points that they gathered. Experience points are awarded based on the practicality and effectiveness of their execution of each task that are given to them. This means, higher points are granted if the outputs that are produced by the students are practical, efficient and show no errors. Whereas lower points will be given if the outputs display signs of errors or not practical in production. Rather than conveying the tasks list with mere words or text to the students, each weekly task list is designed like a scroll (Figure 10) that were used during the medieval ages.

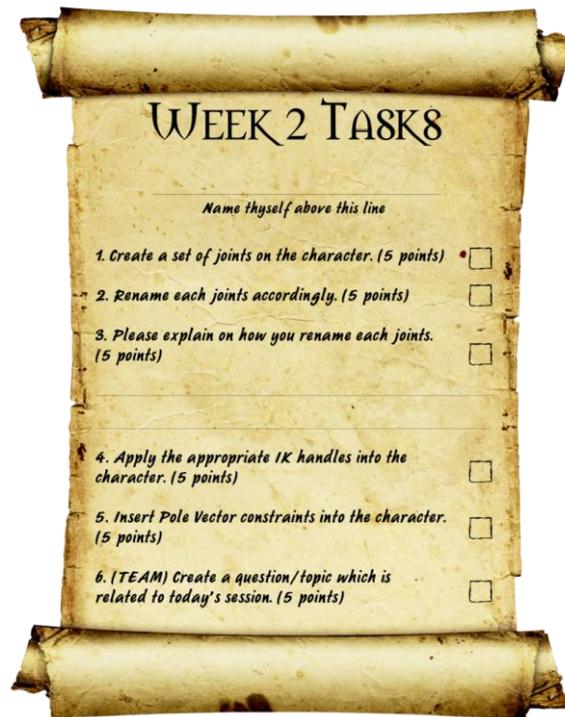


Figure 10 Week 2 tasks list, the rest of the weekly tasks receive the same design template.

Before the start of the CLE, students are required to form a team. Once they form a team, which consist of 4 to 5 members, they are to design their team's insignia. 9 achievement ranks are shown to the students, with each rank is designed like a medieval badge and has its own experience points range, as illustrated in the following table (Table 1).

Table 1 Achievement ranks and experience points range allocations.

Icon	Achievement Ranks	Experience Points Range
	Initiate	0 – 10 points
	Squire	11 – 40 points
	Journeyman/Journeywoman	41 – 70 points
	Knight	71 – 110 points
	Paladin	111 – 150 points
	Baron/Baroness	151 – 200 points
	Earl/Countess	201 – 250 points
	Marquis/Marquise	251 – 349 points



The primary data collection for this research involves each student answering a series of questions during an interview session. The interview's questions are designed to investigate what are their perspectives and the outcomes of their studies when engaging in the CLE in Character Animation.

Result

Introduction of the course was conducted on the 1st week, together with the distribution of the course's assignment and final project brief. Additionally, the concept of self-learning among teammates and completing weekly tasks were explained to the students. At the very start of the 1st week, 4 groups or houses were established. Each groups' house logo, name and their current rank were compiled as a group roster image file, together with the 9 achievement ranks and experience points range indicator (Figure 11). The group roster was updated regularly and displayed during the beginning of each study session, to inform the students of their current rank and the next rank to achieve.

Following the next session, students were clear of the tasks given. During the social learning process, some students were unfamiliar with the new way of learning. This unfamiliarity was to be expected, for most of the students were previously engaged in

teacher-centered learning classes. This CLE was quite new to them, and it took some time for them to adapt into the learning environment. Discussions between the students were minimal at first, but slowly, students were interacting and working with each other.

During the following weeks, discussions between each student were more apparent. These discussions were not only limited within the boundary of each respective groups, as some were mingling with other classmates for technical solutions. Majority of the students were getting accustomed to the CLE, with each team members actively assisting each other to accomplish the weekly tasks. On the following weeks, students displayed the tendencies in being actively engaged in the learning environment, where they assisted each other and openly discuss on which method is suitable or appropriate. At that stage, students were able to discover different knowledge or methods, with minimal reliance on the references that were provided in the LMS. Students took the initiative to explore both the newly obtained method and the existing one, and made comparisons between the two, and decide which one is suitable.



Figure 11 List of groups, members, achievement ranks and experience points' indicator.



Figure 12 A Final Report Scroll awarded to each student, detailing their accomplishments and points gathered in each weekly task.

After each student completed all the weekly tasks, they are presented with a softcopy of the Final Report Scroll (Figure 12), detailing the tasks that they had done, with the respective points that they earned, and a final badge or rank, with the total experience points that they accumulated. Out of the 17 students who participated in this learning environment, a total of 13 students achieved the rank of Viceroy, 3 earned the rank of Marquis/Marquise, and a student received the rank of Paladin.

Once the students' engagement in the CLE is over, they were requested to provide their personal feedbacks in a face-to-face interview. Interpretation of the answers provided by the students yielded interesting and favourable results, detailing their views and experiences while engaging in the CLE in Character Animation. The data collected from the interviews are narrowed down, as follow: -

1. Students' Perception on the Learning Environment;
2. Obtainment of Learning Resources;
3. Interesting Aspects, Rankings and Experience Points System.

Students' Perception on the Learning Environment

Majority of the students expressed positively towards the learning environment, describing it as a totally new, different and beneficial approach, compare to the traditional method. Initially, a small number of students were uncomfortable and had trouble getting into the flow of the CLE. But, after a few weeks of exposure, they slowly began to be accustomed to the CLE. Students commented that the CLE offered much flexibility, freedom, and the convenience for them to study and discuss at their own pace, and they had learnt much from executing each of the weekly tasks.

In the aspect of social learning, students claimed that it was a good and fun experience for them, to discuss and assist each other to solve the weekly tasks. Students apparently prefer to ask their friends for guidance, rather than the lecturer, for fear that they might disrupt an ongoing class. In this learning environment, the students appreciated the facilitator for providing much Coaching (When students raised several technical questions), and the Scaffolding (When students sought additional advance methods). Several students took the opportunity to know each other's skills and weaknesses. The reason being of why they did so, was not to condemn or totally forsake their friends who are weak, but to offer much guidance, so that they can fare well in their upcoming final animation projects.

All students expressed the desire to participate in the CLE again, for most of them felt it was a fun learning experience with their course mates. Additionally, the students claimed that they gained much knowledge by discussing and working together to solve the problems that were presented to them. Some mentioned that they could absorb much information from doing their weekly tasks during classes, in contrast with doing their work alone at home after lectures and tutorial sessions.

Obtainment of Learning Resources

Most of the students relied on the video tutorials which were posted in the LMS. Aside from the video tutorials that were posted, students would also explore for additional video tutorials outside from the LMS, especially from YouTube, for advance methods that could aid them in accomplishing the tasks.

Throughout the entire sessions, the students gained much knowledge in Character Animation from each other, especially from their own teammates. Actively discussing about the topic contributed to their learning, with some students not only limited themselves by having a discussion within their own group, but with other students who are not part of their group. Students benefitted from sharing solutions with each other, not only through face-to-face contact, but through online medium like Facebook chat. However, the LMS forum page served as the primary learning community platform for the students to post questions and to share their own ideas and perceptions. From there, the students could read postings by their fellow friends, who expressed a variety of different approaches and methods, which further expanded the boundary of their understanding in Character Animation. Aside from online videos, discussion forums and the collaboration between themselves, students would also seek the facilitator's advices during consultation periods, and during the CLE, whenever they encounter any difficulties which were out of their league. During the facilitator's demonstrations (Modeling) at the beginning of each sessions, majority of the students fully understood and had an early idea of the tools or methods to apply onto the 3D character model.

Interesting Aspects, Rankings and Experience Points System

More than half of the students were captivated by the Role-Playing elements, defining that it was a unique experience to create their own team with the concept of a medieval clan or house, with the inclusion of the ranking and experience points system. Students were motivated to complete their weekly tasks, by earning experience points. They viewed this as a form of competition between each clan, where they must strive harder to be the best in the class.

Some viewed the ranks as item that bestowed the students with the sense of achievement or accomplishment. Initially, it is to be expected that the Role-Playing elements would be the most interesting aspect to the students, but, the interview data revealed more than that. Some of the students felt that it was the social aspect, where they form into groups to study, share ideas, gain feedbacks from each other, and collaborate to solve the problems in Character Animation.

Students also felt that the E-Learning aspects is an interesting feature in the CLE, where the learning materials are easily assessable anywhere and anytime. Aside from the interesting elements mentioned above, a small fraction of the students thinks that both flexibility and convenience are interesting elements in the CLE. From what can be deduced from there, the students had the flexibility to explore different methods, and were not constricted to only one method that was demonstrated by the facilitator. It might also refer to the flexibility given by the facilitator to the students to engage their learning at their own pace. The convenience term might refer to the availability of both the teammates and facilitator in the learning environment, of whom the students can refer to whenever they face a complicated problem.

Based on the data acquired, it can be concluded that the students did benefitted a lot and gained substantial technical and self-development knowledge to accomplish the Character Animation course. Social constructivism plays a big role in the students' cognitive and technical development, where they formed several study groups to learn amongst themselves. Students independently sought out the knowledge and methods which were required to complete their weekly tasks, and share what they acquired to their friends verbally or through the online discussion forum. The motivation factor that drove the students to complete their tasks, was the introduction of the Role-Playing elements. Though the Role-Playing elements offered were not as comprehensive as a typical game, students felt it was an entirely different learning experience for them to immerse in. Some viewed the gathering of experience points the real motivation factor, which drove them to accomplish their weekly tasks. Students expressed much gratitude and appreciation of the badges and result scroll that were bestowed upon them, and were hoping to participate in the learning environment again.

The students expressed the desire to participate in the CLE again, signifies a strong support of their engagement in the learning environment. Based on the interview, students acquired both the knowledge and technical skills in Character Animation, by executing each of the weekly tasks within the boundary of the CLE. These knowledge and technical skills that they obtained are of great significance, for they will make use of what they had learnt and apply, not only onto their final animation projects, but also, in the 3D animation industry.

Conclusion

The adoption and the introduction of Jonassen's CLE model, combined with Role-Playing elements, broke the passive nature of the students in the tutorial classes, transforming the students into active learners. Additionally, it created a unique and different learning environment that was thoroughly enjoyed by the students. Never had they experienced such learning environment which enabled them to actively collaborate with each other; from seeking and constructing related knowledge or information, to solving real-world or related problems in the context of Character Animation, and to gain ranks and experience points. Students not only developed their understanding in this course, but they also acquired much self-development by being independent and responsible in accomplishing each of the weekly tasks.

Students were motivated to complete the weekly tasks by gathering experience points, and challenge with each other to attain higher rank. These motivations stemmed from the conversion of their experience points to academic points; the higher they accumulate the experience points, the more academic points they will gain. Perhaps in the future, the idea of including Role-Playing elements can be extended, by introducing a variety of character classes with specific skills, and the awarding of various achievement medals or badges.

By the end of this research, students had expressed favourable perception and attitude towards the learning environment with the addition of Role-Playing elements, and they were able to efficiently construct technical and practical based knowledge in Character Animation. Therefore, incorporating Constructivist Learning Environment with Role-Playing elements into 3D animation classrooms provides an innovative, captivating and unique learning experience to the students.

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