Investigating the Key Attributes to Enhance Students' Learning Experience in 21st Century Class Environment

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Abstract: The 21st century marks the beginning of digital age with the extensive use of digital media, mobile devices, and Internet resources. Recent studies found that this digital era has expanded the landscape of student experiences, and educational technologies as well as increased the educator's awareness on embracing technologies to promote effective learning. This has redefined the meaning of effective learning and the approaches in motivating students. Therefore, redesigning the learning environments plays an important role in enhancing the students' experiences in the university classrooms. In this study, the 21st century class environment is designed by mapping Jonassen's model and Gagne's events to employ the constructivist learning approach, organize the information processing, and design the instructions to support effective learning. In order to study student's perception in the 21st century class environment, this study employed the mixed methods approach, includes conducting exploratory factor analysis on the questionnaire response and the qualitative analysis on students' comments. The research samples were formed by 300 undergraduate degree students who studied at INTI International University, Malaysia. The exploratory factor analysis has identified four main factors, group learning, motivation, skills development and knowledge transfer. In the discussion, this study presents the key attributes, the main contributors to the attributes and its impact on student learning. For instance, the factor of group learning can be stimulated by emphasizing on the identified key attributes, such as improved work relationship, improved leadership, and refined collaborative learning which enhancing student learning experience as they are keen to attempt different approach, and anticipate changes. This study aims to identify the factors and elaborate the key attributes for supporting the strategies in transforming the university class environment to enhances students' learning experiences and promote effective learning.

Keywords: students' learning experience, 21st century class environment, effective learning, key attributes

1 Introduction and Literature Review

The 21st century marks the beginning of digital age with the extensive use of social media, mobile devices, and Internet resources. The arrival of digital revolution is now repositioning the process of teaching and learning with the capabilities to promote effective learning and enhance student learning experience. As opposed to the rote memorization, the social process has expanded the educational landscape by encouraging students to exchange ideas, explore new knowledge, co-construct new meanings, and generate mutual understanding (Vygotsky, 1978; Chisanu, Sumalee, Issara & Charuni, 2012; Harris, Jones & Baba, 2013). Studies also show that the well-designed learning environments play an important role in motivating students to form learner community and work collaboration, where they can pool the talents, reflect opinions and develop their own interpretations for problem-solving (Vygotsky, 1978; Cecez-Kecmanovic & Webb, 2000; Johnson & Johnson, 2008; Chiong & Jovanovic, 2012). However, due to the diversities and the lack of study in re-designing the classroom environments, it was reported that students are overwhelmed by the complexity of collaboration and peer interaction, and teachers place less emphasis on students' interaction and capabilities in the class environments (Cecez-Kecmanovic & Webb, 2000; McLoughlin & Lee, 2010). On the other hand, literatures reveal that effective learning is not guaranteed merely by incorporating digital learning technologies, instead it includes enhancing students' social interaction and motivation. However, today's educators are still lack of understanding on the appropriate use of technologies that best suited a situation and support students' needs (Laurillard, Charlton, Craft, Dimakopoulos, Ljubojevic, Magoulas, Masterman, Pujadas, Whitley & Whittlestone, 2011; Stohlmann, Moore & Roehrig, 2012; Downey, Mohler, Morris & Sanchez, 2012). In this study, the discussion focuses on identifying the key attributes in enhancing students' learning experience that bring positive impact on student learning in the university class environment.

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In constructivism, knowledge cannot be transmitted but can be constructed through the meaning making process that related to the real-world situations. Studies found that effective learning can be promoted when the instructional materials and instructional strategies are determined based on the students' experiences. Particularly, when experiencing the challenges, different collaborative approaches and the use of technologies, it can enhance students' motivation, performance and capabilities. Subsequently, it requires less prompting and teacher support as students become more confident and willing to put forth more effort in the learning environments (Duffy and Jonassen, 1992; Neumann & Hood, 2009; Chitanana, 2012; McLaughlin, Roth, Glatt, Gharkholonarehe, Davidson, Griffin, Mumper, 2014). In addition, the growth of social media and online tools bring further social engagement and generate mutual understanding. The knowledge that acquired from social processes and collaborative efforts among students set the opportunities for students to apply conception into practice, debate with their peers, and compare their own practice with that of their peers. This can strengthen the student-student relationships and stay engaged for continued participation, therefore leading to higher sense of ownership in the student-centred learning environment (Vygotsky, 1978; Neumann & Hood, 2009; *Laurillard, 2009).*

Gagne believed that human learning is the permanent change in human capability and occurs with internal processes and external processes. According to Gagne's theory of condition of learning, effective learning can be achieved when the knowledge is communicated efficiently, and the instruction is broken down into simple building blocks with potential values. As such, Gagne stressed that designing the learning environments and developing the learning materials require identifying appropriate learners' mental conditions in order to promote a specific type of learning. For instance, by giving the right problem, appropriate rules and guidance, and intermediate feedback, it trains students' problem solving capabilities (Wager, n.d). These processes also require exposing students to the social interaction and conditions that use their cognitive processes (internal events) for interpreting the environmental stimuli (external events). Gagne's theory of instruction includes the nine events of instruction (1-gaining attention, 2-informing objectives, 3-stimulating recall of prior knowledge, 4- presenting stimulus material, 5-providing learner guidance, 6-eliciting performance, 7-providing feedback, 8-assessing performance, 9-enhancing retention) as a framework for developing educational modules. These events of instruction are described as the external events that can be used by the instructors to address the conditions of learning and structure the learning process for promoting effective learning and enhancing student capabilities (Gagne, 1985; Gagne, Wager, Golas & Keller, 2005). In this study, these events are incorporated in redesigning the learning environment, to support student learning and enhance their capabilities in the group project context.

2 Research methodology

2.1 Design of the 21st Century Class Environment

One of the main objectives of this study is to redesign the conventional class environment into the 21st century class environment where students are tasked to complete a multimedia group project that focus on problem-solving and peer interaction. This design approach was inspired as the literatures show that with the increase of digital literacy among the students, they become more capable to build learner-generated contents and construct new knowledge, especially through exploration, articulation and reflection, it has enriched students' learning experience (Duffy & Jonassen, 1992; Jonassen, 1999; McLoughlin & Lee, 2010).

The design of 21st century class environment mapped Jonassen's model and Gagne's events. Jonassen (1999) model employs the constructivist learning approach to encourage students to construct new knowledge and meaning through the personal experiences and peer interaction. Gagne's events are used to organize the information processing and design the instructions to develop learners' problem-solving skills (Dempsey, 2002). The multimedia group project is the main emphasis of the 21st century class environment. This is also supported by Gagne's condition of learning (1985) as he explained that the problem solving capability is best trained when the right problem and appropriate guidance are given. Hence, this project includes a problem situation and the development process includes considering restrictions, defining the meaning, showing the relevance, creating new ideas, as well as making sense to the context. One of the samples of the project title is that *"[assuming that] Milo Malaysia needs to rebrand their products with new appearance and presents through an interactive e-book named as 'Your Day with Milo'. This e-book will be added in the official website and the touch-screen kiosks at supermarkets. The e-book includes a new design of product logo and tagline*

with a trendier appearance; proposes new packaging design with Malaysia context but the core design should be maintained; and showcases all categories of Milo products in friendly and informative way"

2.2 Data Collection Process

The data collection process employs multiple research instruments, including questionnaire, open-ended questions, and interview. The questionnaire consists of 40 survey items. The survey items were adopted from several research projects with similar research scope. Each item is to be responded based on 5-point Likert scale, ranging from 1 as a result of strongly disagree to 5 as a result of strongly agree. The open-ended questions and interview are to obtain students' experience on group collaboration and their opinions on developing a multimedia group project. It aims to collect fuller details and more aspects of expression to complement and extend the limit of survey questions. In the process of data analysis, the collected data are triangulated in the mixed-method approach to study the impact of this 21st century class environment on student learning, particularly to identify the key attributes to enhance students' learning experience.

2.3 Research Sample

The research samples consists of 300 undergraduate students. The selection was based on the simple random sampling technique in which it represented the entire student population who enrolled in IT courses at INTI International University, Malaysia and studied the module of "Graphic Design and Animations" during the period of data collection, from year 2012 to year 2015. The student demography recorded that 74.2% of Malaysian students, and 25.8% of international students, and among all, majority are male students, consisted of 79.7%, and 23.3% of female students. The class environment was set at the lecture classes at INTI International University, with the emphasis on developing the multimedia group project that involved every student in the development process throughout the whole semester. In this learning process focused on developing students' problem-solving skills, communication skills, and critical thinking skills, as well as the software skills in using the multimedia development software for content creation.

3 Data analysis and results

The data analysis was done to generate the results for discussions.

3.1 Exploratory factor analysis

Exploratory Factor analysis (EFA) was used to analyse the item response in the questionnaire for exploring the students' perceptions and learning experiences. Overall, this research study has executed four rounds of EFA process to present a clean factor structure which consists only loadings of .5 and above. The 5-step Exploratory Factor Analysis Protocol was employed to ensure the accuracy (Field, 2009; Williams & Brown, 2010; Taherdoost, Sahibuddin & Jalaliyoon, 2014).

1. **In determining the sample size,** the sample size of 300 is acceptable to perform EFA. This is considered a larger sample size which is more adequate and accurate in defining the number of factors.

2. **In selecting the factor extraction method**, the PCA with orthogonal varimax rotation is employed as it is the most commonly used multivariate technique for identifying the linear components and to maximizing the dispersion of factor loadings and making the factors more interpretable and meaningful (Field, 2009; Tabachnick & Fidell, 2012). The correlation matrix indicates that the correlation is between 0.3 to 0.9, which shows that the survey items correlate well as the loading of 0.30 is the minimal and 0.50 is considered significant to display the inter-correlations (Hair, Black, Babin & Anderson, 2009; Tabachnick & Fidell, 2012). The record of .928 in Kaiser-Meyer-Olkin (KMO) Measure shows high confidence on the sampling adequacy. The result of Bartlett's test of Sphericity, X^2 (300) = 3453.604, p <.001, also shows that the correlations between items is also proved sufficiently large for PCA (Field, 2009; Hair et al., 2009; Tabachnick & Fidell, 2012).

3. **In determining number of factors to retain,** Kaiser's criteria is selected as it is more accurate as the sample size exceeds 250 and the average communality is very close to 0.6 (14.18/25 = 0.5672) (Field, 2009; Williams & Brown, 2010). The result of factor extraction shows a cumulative percentage of variance of 56.723% with a total of 4 factors which have an eigenvalue of greater one (see Table #).

Based on the scree plots of eigenvalues (see Figure #), the curve begins to flatten out after 4 factors, which representing the point of inflexion. Hence, in lining with Kaiser's rule, four factors are to be retained for interpretation.

4. **In selecting the rotating methods,** the orthogonal varimax rotation which capable of maximizing high item loadings is used to produce factor structures. The factor loading is set at 0.5 as the cut-off point as it is considered as strong factor loading coefficient (Tabachnick & Fidell, 2012; Yong & Pearce, 2013). A total of 25 variables were remained in the rotated component matrix after executing four rounds of EFA process to suppress the loadings below .5. Table # shows the rotated component matrix with four factors. As each factor is considered meaningful with at least two highly loaded variables, it is acceptable that 14 items are loaded onto factor one, 4 items are loaded onto factor two, 4 items are loaded onto factor three, 3 items are loaded onto factor four.

5. **In summarizing and labelling data,** the factor structure is developed from 25 survey items with the sample size of 300 by using the principle component analysis (PCA) and orthogonal varimax rotation. The Kaiser-Meyer-Olkin (KMO) measure shows adequate sampling with the result of .928. The Bartlett's test of sphericity indicates sufficiently large correlations between items with the result of X^2 (300) = 3453.604, p <.001. There are four factors found to have eigenvalues over Kaiser's criterion of 1, and capable of explaining 56.723% of the variances. The attributes of the survey items are considered in setting the themes for each identified factors for the interpretations (see Descriptive Analysis section). The theme for each factor are: Group learning (FAC1), Motivation (FAC2), Skills Development (FAC3), and Knowledge Transfer (FAC4).

Table 1 Total Variance Explained

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.899	35.597	35.597	6.708	26.831	26.831
2	2.769	11.076	46.674	2.992	11.967	38.798
3	1.400	5.601	52.275	2.583	10.332	49.129
4	1.112	4.448	56.723	1.898	7.594	56.723

Extraction Method: Principal Component Analysis.

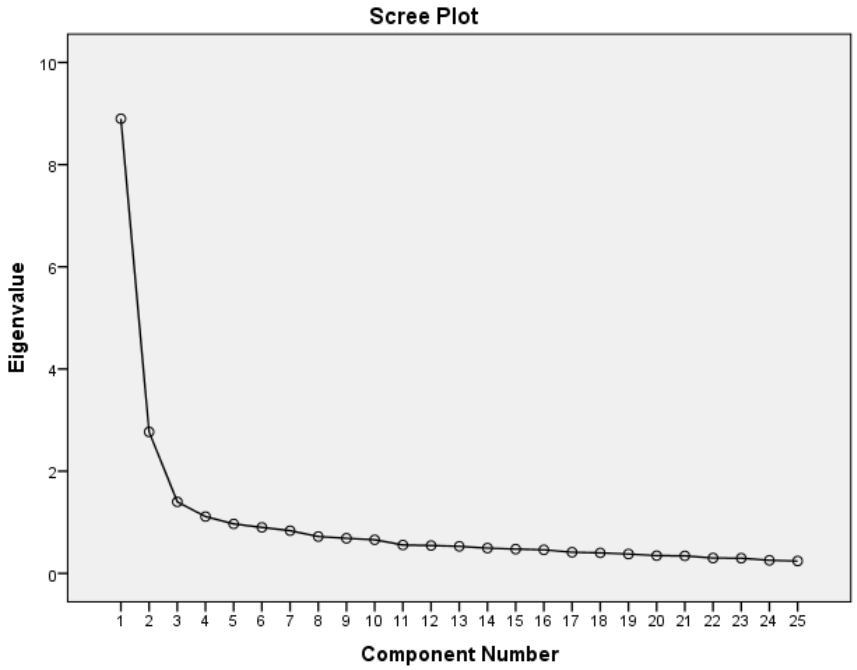

Figure 1 Scree plots of eigenvalues

Table 2 Rotated Component Matrix with 4 components

	Factors			
	1	2	3	4
My group communicated well with each other	.795			
My group was supportive of member's problems and helped resolved them	.744			
My group helped me do my best in the project	.733			
There was a lot of unity in my group	.722			
My group leader was very effective	.711			
My group taught me some things I would not have learnt on my own	.694			
My group's interactions were smooth	.681			
Our group encouraged positive contributions from each member	.667			
I enjoy working in a team	.659			
My group was able to solve our problems and conflicts in a positive manner	.657			
Our meetings were well attended.	.642			
I got to know my group members well	.623			
I learn more from the collaboration than on my own	.569			
We were able to organise our work effectively	.504			
I was very motivated to do this project		.755		
I enjoyed working on a project like this		.719		
The project made me want to do my best		.695		
I am very satisfied with my contribution to the project		.633		
I enjoyed using the web to acquire information for my project			.754	
I was able to maintain contact with my lecturer			.750	
I found using the Web to communicate my progress very useful in my learning			.663	
The project allowed me to develop and improve my presentation skills			.561	
I am now able to apply my skills in a more effective manner on future projects				.599
We were able to complete all our tasks on time				.538
The project increased my understanding on how to manage and develop an interactive application				.505

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 8 iterations.

3.2 Cronbach's Alpha Test for Reliability

In assessing the internal consistency in each of the identified factors, Cronbach's Alpha test for reliability was conducted. Overall, it shows the result of 0.921 for all 25 retained items. Particularly, factor 1 (with 14 items) shows the Cronbach's Alpha test result of 0.927, factor 2 (with 4 items) shows the result of 0.764, factor 3 (with 4 items) shows the result of 0.722, factor 4 (with 3 items) shows the result of 0.580. According to George & Mallery's (2003) rules of thumb, all 25 retained items as well as factor 1, factor 2, and factor 3 can be accepted as a reliable survey as the Cronbach's Alpha test result is above 0.7. On the other hand, with a larger sample size and considering the number of items in one factor, factor 4 which has the result below the average cut-off point of 0.7 can still be accepted as a reliable survey (Gliem & Gliem, 2003).

3.3 Descriptive Analysis

The descriptive analysis is used to present the mean scores and standard deviation of each identified factor. It also studies the mean, the cumulative percentage of agree response (combining both strongly agree and agree) of each of the survey item.

As for the factor of Group Learning (FAC1), due to the large number of items, another round of factor analysis was done to sub-divide into two sub-factors, themed as peer interaction and teamwork.

The Peer Interaction sub-factor (FAC1-sub1) consists of nine items with the mean of 3.9252 and the standard deviation of .63520 (see table #).
By selecting the items with the mean score of above 4.0, it shows that:

- 80.67% of students agreed that they know their group members well.
- 77.67% of students agreed that the group helped to do his/her best in the project.

By selecting the items with the mean score of above 3.9, it shows that:

- 75% of students agreed that their group encouraged positive contributions.
- 73.67% of students agreed that their group supported in problem solving.
- 76.67% of students agreed that their group was able to solve problems and conflicts.

By selecting the items with the mean score of above 3.8, it shows that:

- 66.67% of students agreed that members attended the group meeting.
- 69% of students agreed that their group interactions were smooth.

By selecting the items with the mean score of above 3.7, it shows that:

- 68% of students agreed that the members are united.
- 61.67% of students agreed that they were able to organize the work efficiently.

The results reflected that the students' peer interaction has great influence from the good relationship among the group members which was built prior to the group project. The students commented that "*we knew each other for quite a long time*", "*…team members have their own strengths and weaknesses which can compliments to the development*", *"…and we have work with each other before and are familiar with each other's capabilities*". This explains that the familiarity and past experiences in strengths, capabilities, and personal preferences determine the process of building the work relationship in the group project. With good work relationship, students become more comfortable and active in contributing efforts and providing their supports. These include staying proactive in uniting the group members, sharing the capabilities and resources, and dealing with conflicts in a more positive way. These can be seen from the students' responses, such as *"…we propose our own ideas to each other and choose the best one…"*, *"…he suggested an idea, then all of us seconded his idea and add more, whatever happened, we just work together, we don't blame each other*", *"…we all stay nearby, so we can call them to meet at 1 house then discuss and do works*".

Table 3 Descriptive Statistics for peer interaction *(FAC1-sub1)*

	N	Minimum	Maximum	Mean	Std.	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Fac1_1	300	1.56	5.00	3.9252	.63520	.403	-.591	.141
Valid N (listwise)	300							

Table 4 Responses of survey items for peer interaction *(FAC1-sub1)*

Survey Items	**Mean (M)**	**STD**	**Cum.Agree (%)**	**SA (%)**	**A (%)**	**U (%)**	**D (%)**	**SD (%)**
I got to know my group members well.	4.17	0.744	80.67	37.67	43.00	17.67	1.67	0.00
My group helped me do my best in the project.	4.07	0.836	77.67	33.00	44.67	19.33	2.33	0.67
Our group encouraged positive contributions from each member.	3.99	0.863	75.00	28.33	46.67	22.00	1.67	1.33
My group was supportive of member's problems and helped resolved them.	3.98	0.840	73.67	29.33	44.33	22.67	2.67	1.00
My group was able to solve our problems and conflicts in a positive manner.	3.95	0.766	76.67	22.67	54.00	19.33	3.33	0.67
Our meetings were well attended.	3.86	0.945	66.67	28.67	38.00	26.00	5.00	2.33
My group's interactions were smooth.	3.85	0.908	69.00	24.33	44.67	24.67	4.67	1.67
There was a lot of unity in my group.	3.79	0.891	68.00	20.33	47.67	24.33	6.00	1.67
We were able to organize our work effectively.	3.67	0.860	61.67	13.67	48.00	31.67	5.00	1.67

The sub-factor Teamwork (FAC1-sub2) consists of five items with the mean of 3.9573 and the standard deviation of .70168(see table #).

By selecting the items with the mean score of above 4.0, it shows that:

- 75.33% of students agreed that their group leader was effective.

By selecting the items with the mean score of above 3.9, it shows that:

- 72.33% of students agreed that their group has good communication.
- 75.33% of students agreed that their group taught them lessons that they would not have learnt on their own.
- 74.00% of students agreed that they learnt more from the collaboration.
- 71.33% of students agreed that they enjoy team-working.

The results reflected that the students emphasized more on the leadership, followed by valuing the quality of communication and the new lessons gained through the teamwork, even though some students felt dissatisfied and less enjoying in the teamwork. The students' responses include *"…my leader find information needed for the project, correcting mistakes of other members' works, she has a sense of responsibility…"*, *"…this project allowed me to realise than I will meet different people and require different levels of understanding of communication that I have to adapt to..."*, *"…however, we accept any suggestion from each other…I feel that communication with each other is very important"*, *"…but only few of the members are not that putting effort on it sometimes"*, *"…maybe it is my mistake because I should know how to lead better and handle all people…"*.

Table 5 Descriptive Statistics for teamwork *(FAC1-sub2)*

	N	Minimum	Maximum	Mean	Std.	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Fac1_2	300	1.00	5.00	3.9573	.70168	.492	-.952	.141
Valid N (listwise)	300							

Table 6 Responses of survey items for teamwork *(FAC1-sub2)*

Survey Items	**Mean (M)**	**STD**	**Cum.Agree (%)**	**SA (%)**	**A (%)**	**U (%)**	**D (%)**	**SD (%)**
My group leader was very effective.	4.04	0.922	75.33	34.67	40.67	21.00	1.33	2.33
My group communicated well with each other.	3.97	0.893	72.33	31.33	41.00	22.00	4.67	1.00
My group taught me some things I would not have learnt on my own.	3.96	0.894	77.33	27.00	50.33	17.33	2.33	3.00
I learn more from the collaboration than on my own.	3.92	0.810	74.00	24.00	50.00	21.67	2.67	1.67
I enjoy working in a team.	3.90	0.879	71.33	26.33	45.00	22.00	5.33	1.33

The factor of motivation (FAC2) consists of four items with the mean of 3.9358 and the standard deviation of .60017 (see table #).

By selecting the items with the mean score of above 4.0, it shows that:

- 85.67% of students agreed that the project made them do their best.

By selecting the items with the mean score of above 3.8, it shows that:

- 70% of students agreed that they are satisfied with their own contributions
- 71% of students agreed that they enjoyed working on group project.
- 75.67% of students agreed that they were very motivated to do the project.

The results reflected that the multimedia group project plays an important role in motivating the students and stimulating them to put forth efforts to achieve a higher goal. Students said that *"I finally have chances able to apply the shooting technique…", "… struggle using this software had taught me not to give up easily & creative to find solution…".* As students were stimulated by recognise their new capabilities in the project development, they become more positive towards accepting challenges with less objection and resistance, as well as becoming more resourceful and self-reliable in the learning process. This can be seen from the students' responses that *"…I have the thought that if I can do it once I can do it again…"*, *"…spent most of the time to do*

the animation part, felt accomplishment…", "…teach my member how to trace a photo to his poster", "*I feel so excited because I can know how far my idea and how good I am…*". These feedback reflects that the students can see their own significance and the positive changes as they become motivated in the learning process who then gain more determination to adjust their actions self-purposefully.

Table 7 Descriptive Statistics for motivation *(FAC2)*

	N	Minimum	Maximum	Mean	Std.	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Fac2	300	1.75	5.00	3.9358	.60017	.360	-.563	.141
Valid N (listwise)	300							

Table 8 Responses of survey items for motivation *(FAC2)*

Survey Items	**Mean (M)**	**STD**	**Cum.Agree (%)**	**SA (%)**	**A (%)**	**U (%)**	**D (%)**	**SD (%)**
The project made me want to do my best	4.15	0.690	85.67	31.00	54.67	12.67	1.67	0.00
I am very satisfied with my contribution to the project.	3.88	0.763	70.00	22.33	47.67	25.67	4.33	0.00
I enjoyed working on a project like this.	3.86	0.865	71.00	22.67	48.33	22.00	6.33	0.67
I was very motivated to do this project.	3.85	0.808	75.67	15.67	60.00	20.00	2.67	1.67

The factor of skills development (FAC3) consists of four items with the mean of 3.9117 and the standard deviation of .58667 (see table #).

By selecting the items with the mean score of above 4.0, it shows that:

- 78% of students agreed that they enjoyed using web to seek for the resources in project development.

By selecting the items with the mean score of above 3.9, it shows that:

- 73% of students agreed that it is useful for using web to communicate and update the work progress.

By selecting the items with the mean score of above 3.8, it shows that:

- 72.33% of students agreed that their presentation skills can be improved through the project development.
- 69% of students agreed that they were able to maintain contact with their lecturers.

The results reflected that the students feel confident and comfortable with the use of web resources in searching for necessary information and sharing the updates with each other. Students commented that "*…we used the websites, we can check the information online, more interesting…", "…I like to browsing for the design on the website…then I learned from there…*", *"…we refer to website…make it as reference and then we set the topic…*". Hence they become more flexible in complementing each other. The students responded that *"…member skilled in different field can deal with different challenges & complement one another…*", "*I felt grateful for whatever experience that I had gone through…*". As the project development is well-supported with the web technologies and students become more experienced in managing the web resources, it therefore enhances students' presentation skills and communication skills in the class environment. The students' responses include *"…we collaborate online & using social media to ensure group is constantly connected…", "…this type of learning made me realize how important it is to have good collaboration with others…", "…I observed classmates who have much more fascinating ideas…"*

Table 9 Descriptive Statistics for skills development *(FAC3)*

	N	Minimum	Maximum	Mean	Std.	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Fac3	300	2.25	5.00	3.9117	.58667	.344	-.123	.141
Valid N (listwise)	300							

Table 10 Responses of survey items for skills development *(FAC3)*

Survey Items	Mean (M)	STD	Cum.Agree (%)	SA (%)	A (%)	U (%)	D (%)	SD (%)
I enjoyed using the web to acquire information for my project.	4.03	0.758	78.00	27.33	50.67	20.00	1.67	0.33
I found using the Web to communicate my progress very useful in my learning	3.90	0.825	73.00	21.33	51.67	23.00	3.33	0.67
The project allowed me to develop and improve my presentation skills.	3.87	0.823	72.33	19.33	53.00	24.00	2.67	1.00
I was able to maintain contact with my lecturer.	3.85	0.882	69.00	22.00	47.00	26.00	4.00	1.00

The factor of the knowledge transfer (FAC4) consists of three items with the mean of 3.9167 and the standard deviation of .59798 (see table #).

By selecting the items with the mean score of above 4.0, it shows that:

- 83% of students agreed that the project has increased their understandings on managing and developing the multimedia application.
- 80% of students agreed that the newly learned skills can be applied on future projects.

By selecting the items with the mean score of above 3.6, it shows that:

- 57.33% of students agreed that their tasks were completed on time.

The results reflected that even though many groups were unable to complete the tasks in the development process, however the project has stimulated and increased students' learning interests in various aspects and diversified their experiences with the real-world perspectives. The students responded that "*…faced a lot of obstacles, but after I manage to complete a part, I feel very proud and more motivated to continue…*", *"…was frustrated because we can't do what we plan, but as we learn more…we can do the design…"*, *"…I feel it is hard but still inspire me to do it…*". On the other hand, as students gained new skills and knowledge in this learning environment, they showed confidence and readiness to transfer the new skills and generalize their new knowledge for further studies and advancing to the higher level of achievements.
Students' responses with good anticipations include "*…it is the basic that I need to learn to go advance level of my course…*", "*I can do better graphic design on further project…*", *"I look forward to working on more projects like this in the future and to apply the knowledge…*".

Table 11 Descriptive Statistics for knowledge transfer *(FAC4)*

	N	Minimum	Maximum	Mean	Deviation	Variance	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Fac4	300	1.33	5.00	3.9167	.59798	.358	-.470	.141
Valid N (listwise)	300							

Table 12 Responses of survey items for knowledge transfer *(FAC4)*

Survey Items	Mean (M)	STD	Cum.Agree (%)	SA (%)	A (%)	U (%)	D (%)	SD (%)
The project increased my understanding on how to manage and develop an interactive application.	4.14	0.736	83.00	32.00	51.00	16.00	0.67	0.33
I am now able to apply my skills in a more effective manner on future projects.	4.01	0.766	80.00	24.33	55.67	17.67	1.33	1.00
We were able to complete all our tasks on time.	3.60	0.987	57.33	16.33	41.00	32.00	8.00	2.67

4 Discussion

In this section, the factors and students responses are analysed and elaborated to study the key attributes of each factor, along with the contributors and the impact on student learning experience in the 21st century class environments.

Table 2, it shows that:

1. The factor of group learning can be stimulated by emphasizing on the key attributes of improved work relationship, positive attitude in contributing ideas, active participation, improved leadership, and refined collaborative learning. Student learning experience is then enhanced as they are keen to provide helps, accept different opinion, attempt different approach, and anticipate changes. This study has revealed that student learning experience can be a unique and valuable process when they are provided with the flexibility in self-constructing the knowledge. Particularly, when the learning environment is designed with real-world approach, students get to apply critical thinking to make sense of their knowledge and resources for generating the solutions towards different situations (Duffy & Jonassen, 1992; Neumann & Hood, 2009; Laurillard, 2009).

2. The factor of motivation can be stimulated by emphasizing on the key attributes of making best effort, and feeling satisfied in learning. These bring the impact of students looking forward to perform better, more determined to set purpose and achieve higher goal. The result is consistent with the literatures that as students' competence increases, their motivation increases. It can be seen that gaining new capabilities, skills and knowledge in the project development process has motivated students to handle the tasks with more confidence and satisfaction. According to Gagne (1985), when an appropriate condition is met, a specific type of learning can be best promoted. Therefore, it can be understood that as the students recognize their new capabilities and new achievements in the process of self-discovery, it urges the student to anticipate new goals and purposes, and become less fear towards new learning opportunities.

3. The factor of skills development can be stimulated by emphasizing on the key attributes of use of web resources, enhanced online communication, and meaningful presentation. Student learning experience is then enhanced as they mastered the skills in managing the resources, involved in online community, gain confidence in delivering the messages. This supports the fact that the advancement in skills lead students to believe in own potential as well as becoming more independent in exploring new possibilities or evaluating the risks. The sense of ownership that developed in the 21st century learning environment can then cultivate active learning which brings more pleasurable experience when students play a role in the learners' community and get connected in the social processes by complementing each other in the content creation process (Vygotsky, 1998; *Laurillard, 2009;* Neumann & Hood, 2009; Chiong & Jovanovic, 2012*).*

4. The factor of knowledge transfer can be stimulated by emphasizing on enhanced knowledge on project management and readiness for future developments. The impact on student learning can be considered from the aspects of students advancing to higher level of performance and seeking for more opportunities to diversify new knowledge. *This study* is consistent with the fact that the social contextual support in Jonassen's CLE model is an important component where it emphasizes on the significance and the value on self-respecting especially to those who have low self-esteem and weaker performance. With the inclusion of social contextual and processes, the 21st century class environment is more practical to illustrate the actual processes in tasks organisation, project management, and problem solving which develop and enhance students' transferable skills.

Table 13: Key attributes of each factors, the contributors the impact on student learning

Key attributes	Contributors to the attributes:	Impacts on student learning
Factor 1 – Group Learning **Sub-factor 1 – Peer Interaction**		
Improved work relationship	When the students were allowed to select the peers who are known with past experiences/ activities.	Students tend to be more active and keen to provide helps and suggestions to those who they are familiar with.
Positive attitude in contributing ideas	When the students were encouraged to share thoughts which come from their own experiences, expertise, or personal preferences.	Students started to realise the differences and open for considering others' opinions in solving problems.
Active participation	When the students were invited to attend events/meeting where their presence serves an important purpose.	Students attempted different approaches to organize tasks and unite the members to suit the situations.
Factor 1 – Group Learning **Sub-factor 2 – Teamwork**		
Improved leadership	When the students were assigned with leadership roles to unite the team, supervise the process, deal with conflicts.	Students found the changes to practice the sense of responsibility for different stages of works.
Refined collaborative learning	When the students were convinced that the team make them to learn more effectively and enjoyably than individual learning or being isolated.	Students started to anticipate changes and felt more pleasure in sharing of thoughts and resources with others.
Factor 2 – Motivation		
Make best effort	When the students were trusted with their performance and given an important role to achieve the goal.	Students look forward to perform better and achieve higher goal.
Feel satisfied in learning	When the students were given chance to explore and innovate by knowing the differences, seeing the changes or observing the results.	Students have clearer mind in determining the purposes and outcomes for more personal gain.
Factor 3 – Skills Development		
Use of web resources	When the students were required to source to materials and resources to develop a complicated project.	Students practiced various skills and methods in searching and managing the online resources.
Engaged online communication	When the students were guided to build community in web 2.0 tools and social network sites.	Students interacted more extensively in social media with more discussion topics, more disputes, and more updates.
Meaningful presentation	When the students were encouraged to generate creative contents with multimedia elements.	Students became more confident and capable in using media-rich content to present and deliver the messages.
Factor 4 – Knowledge Transfer		
Enhanced knowledge on project management	When the students were challenged to handle a complex multimedia project.	Students were more impressed and proud on their successful achievements which inspired them to advance to higher level of performance.
Readiness for future developments	When the students were exposed to project with real-world contexts for problem-solving.	Students started to seek for more opportunities to diversify and apply their new knowledge in different situations for more experiments.

5 Conclusion

Strengthening students' capabilities have been the main focus in the education reform research for the aims of building the 21st century learning environment with modern tools, media-rich contents, and innovative pedagogical approaches. In this study, it has identified and elaborated four factors that bring impacts on student learning in the 21st century learning environment, to promote effective learning and enhance students' learning experience. As the summary, the group learning can be stimulated by mainly having improved work relationship and improved leadership to transform students into active learning and gain the sense of responsibility. The motivation comes from students making effort and feeling satisfied in the learning process which then lead them to perform better and set a higher goal of achievements. The students' skills development requires the support of the web resources, engaged online communication and meaningful presentation to bring the impact of being capable in managing the resources, utilising the social tools and media for delivering messages. The knowledge transfer can be stimulated by having enhanced knowledge on project management and readiness for future developments which inspired students to advance and diversified their knowledge and skills into different situations. This study can be concluded that the students' learning experience can be enhanced as the learning environment is designed to support and promote effective learning, particularly when the technologies and media-rich contents are used to co-construct new meaning and knowledge. Overall, this study contributes the factors and key attributes which support the strategies in transforming the university class environment to enhances students' learning experiences and promote effective learning.

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