STUDENTS' AFFECTIVE STATE ON DIFFERENT KAWAII DESIGNS OF PEDAGOGICAL AGENTS AND ITS EFFECT ON MOTIVATION IN LEARNING

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KALIYAMAH RAMAN

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ABSTRACT

While the use of pedagogical agent in education is a growing phenomenon, it is still unclear on which particular facial features of a pedagogical agent is effective to be used in Virtual Learning Environment (VLE). If the different kawaii designs of pedagogical agents are capable of making a good first visual impression, students will likely be enticed with it and stay focused throughout the learning process. Hence, the purpose of the research is to determine students' affective states on different kawaii designs of pedagogical agents and its effect on their motivation in VLE. For that reason, two different kawaii designs of pedagogical agents are developed namely kawaii pedagogical agent with baby schema and kawaii pedagogical agent without baby schema. The research used quasi-experimental design and the data analysed using one-way analysis of covariance (ANCOVA) and mediation analysis. Using a multistage sampling method, 201 electric engineering students from four polytechnics of Malaysia were selected as a sample for the research. The results revealed that kawaii pedagogical agent with baby schema scored the highest mean score for affective states followed by kawaii pedagogical agent without baby schema. Interestingly, both the different kawaii designs of pedagogical agents fall on a higher rate of positive affective states. It has been found that kawaii pedagogical agent with baby schema scored the highest mean score for students' motivation in learning in the VLE followed by kawaii pedagogical agent without baby schema. The mediation analysis shows that students' affective states play a role as mediator in the relationship between the two different kawaii designs of pedagogical agent and motivation in learning. As conclusion, this research recommends kawaii design as an effective design solution for the development of pedagogical agents. Interestingly, kawaii pedagogical agent with baby schema is the most suitable agent for VLE followed by kawaii pedagogical agent without baby schema.

KEADAAN AFEKTIF PELAJAR TERHADAP REKA BENTUK *KAWAII* YANG BERBEZA DARI EJEN PEDAGOGI DAN KESANNYA TERHADAP MOTIVASI DALAM PEMBELAJARAN

ABSTRAK

Walaupun penggunaan ejen pedagogi dalam pendidikan adalah fenomena yang semakin meningkat, ia masih tidak jelas mengenai ciri-ciri wajah tertentu ejen pedagogi yang mana berkesan untuk digunakan dalam persekitaran pembelajaran maya. Jika reka bentuk *kawaii* yang berbeza dari ejen pedagogi sedia ada mampu memberikan kesan visual pertama yang baik, maka mungkin akan lebih menarik perhatian pelajar sepanjang proses pembelajaran. Oleh itu, tujuan kajian ini adalah untuk menentukan keadaan afektif pelajar terhadap reka bentuk *kawaii* yang lebih berkesan terhadap motivasi mereka dalam persekitaran pembelajaran maya. Sehubungan itu, dua reka bentuk *kawaii* yang berbeza dari ejen pedagogi dibangunkan iaitu *kawaii pedagogical agent with baby schema* dan *kawaii pedagogical agent without baby schema*. Kajian ini menggunakan eksperimen kuasi dan data yang diperolehi telah dianalisis dengan menggunakan *one-way analysis of covariance (ANCOVA)* dan analisis mediasi *(mediation analysis).* Kaedah persampelan pelbagai peringkat terhadap 201 pelajar kejuruteraan elektrik dari empat politeknik Malaysia telah dipilih untuk penyelidikan ini. Hasil kajian menunjukkan bahawa *kawaii pedagogical agent with baby schema* mendapat skor min tertinggi untuk keadaan yang lebih afektif berbanding *kawaii pedagogical agent without baby schema*. Menariknya, kedua-dua reka bentuk *kawaii* ejen pedagogi berada pada keadaan afektif positif yang tinggi. Ia telah didapati bahawa *kawaii pedagogical agent with baby schema* mendapat skor min yang tertinggi untuk motivasi pelajar dalam persekitaran pembelajaran maya yang diikuti oleh *kawaii pedagogical agent without baby schema*. Analisis mediasi menunjukkan bahawa keadaan afektif pelajar berperanan sebagai *mediator* dalam hubungan antara dua reka bentuk *kawaii* yang berbeza dari ejen pedagogi dan motivasi dalam pembelajaran. Sebagai kesimpulan, penyelidikan ini mengesyorkan reka bentuk *kawaii* sebagai penyelesaian reka bentuk yang berkesan untuk pembangunan ejen pedagogi. Menariknya, k*awaii pedagogical agent with baby schema* adalah agen yang paling sesuai untuk persekitaran pembelajaran maya dan ianya diikuti oleh *kawaii pedagogical agent without baby schema.*

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LIST OF ABBREVIATIONS

2D	Two-Dimensional
3D	Three-Dimensional
ANCOVA	Analysis of Covariance
DET	Diploma in Electrical Engineering
DTK	Diploma in Electronic Engineering (Computer)
IMMS	Instructional Material Motivation Surveys
KB	*Kawaii* Pedagogical Agent with Baby Schema
KWB	*Kawaii* Pedagogical Agent without Baby Schema
PALD	Pedagogical Agents-Levels of Design
PANAS	Positive and Negative Affect Schedule
PRE-IMMS	Pre-Instructional Material Motivation Surveys
PRE-PANAS	Pre-Positive and Negative Affect Schedule
POST-IMMS	Post-Instructional Material Motivation Surveys
POST-PANAS	Post-Positive and Negative Affect Schedule
PSSUQ	Post-Study System Usability Questionnaire
SAM	Successive Approximation Model
SPSS	Statistical Package for Social Science
VLE	Virtual Learning Environment

LIST OF APPENDICES

A	Experts' Validation on the Character's Design
B	Experts' Validation on the Design of Virtual Learning Environment
C	Expert's Validation on the Dialogues
D	Experts' Validation on the Content of Virtual Learning Environment
E	Experts' Validation on the language used in the Instruments
F	Permission to use Instruments from Official Copyright holder
G	Instruments
H	The Output of SPSS
I	Letters

CHAPTER 1

INTRODUCTION

1.1 Introduction

A pedagogical agent is an animated lifelike character with human-like behaviours, speech, gesture and movement that is used for computer-aided learning (Johnson, Rickel & Lester, 2000; Park, 2018). Pedagogical agents have been widely implemented in various virtual learning platforms. Accordingly, pedagogical agents serve various instructional roles such as mentor (Baylor & Kim, 2005; Sabu, 2018), learning companion (Johnson & Lester, 2016; Kim, Baylor & Shen, 2007; Woolf et al., 2010), tutors, coaches, life-long learning partners (Chou, Chan & Lin, 2003; Mohanty, 2016) and teachable agents (Biswas, Leelawong, Schwartz & Vye, 2005; Song, 2020).

In instructional settings, pedagogical agent can represent a human role by communicating effectively with students both visually and verbally (Clark & Mayer, 2016; Vicneas & Ahmad Zamzuri, 2019, 2020). Adding such animated pedagogical agent in Virtual Learning Environment (VLE) creates social connection between pedagogical agent and student that in turn, promote interest in learning task among students (Goldberg & Cannon-bowers, 2015; Gulz & Haake, 2006; Mohammadhasani, Fardanesh, Hatami, Mozayani & Fabio, 2018; Moreno, Mayer, Spires & Lester, 2001). Clearly, during the social interaction between pedagogical agent and students, physical cues of the pedagogical agent profoundly affect students' belief and their behaviour (Caruana, Spirou & Brock, 2017; Gulz & Haake, 2006). Hence, a well-designed animated pedagogical agent in educational context has the potential to increase motivation among students (Gulz & Haake, 2006; Mohanty, 2016). As a result, bigger prominence should be given on the design of pedagogical agent.

Various design elements can contribute to the creation of rich and interesting personality of animated pedagogical agent. In this respect, past studies focused on the effect of realism designs for the visual appearance of pedagogical agents in educational environments (Kogilathah, Ahmad Zamzuri & Wee Hoe, 2021; Liew, Mat Zin, Sahari & Tan, 2015; Ahmad Zamzuri & Mohd Najib, 2016; Vicneas & Ahmad Zamzuri, 2019, 2020). It was believed that when a character design approaches high degree of visual realism and as it reaches a certain point, it will cause eeriness to the viewers which is called as uncanny valley phenomenon (Ahmad Zamzuri & Najib, 2016; Mori, 2012; Sloan, 2015; Vicneas & Ahmad Zamzuri, 2019, 2020). Consequently, a very high level of realism in pedagogical agent may cause viewers to reject the agent (Kogilathah, Ahmad Zamzuri & Wee Hoe, 2019; Vicneas & Ahmad Zamzuri, 2019, 2020).

Obviously, it shows that the acceptance of a pedagogical agent among viewer dependent on its appealing visual appearance of pedagogical agent (Hietala & Niemirepo, 1998; Vicneas & Ahmad Zamzuri, 2019, 2020).

Following the advancement of computer technology, visual appearance of a pedagogical agent is represented in human form (Martha & Santoso, 2019). However, which human-like visual appearance of a pedagogical agent contributes to increase motivation in learning among students is still unclear. Basically, faces are the most predominant factor seen during interactions among people and it capable to form first impression (Garrido & Prada, 2017). Face to face interaction is capable to increase the feelings of connectedness, increase happiness and lower the depression (Lee, Murphy & Andrews, 2019). People feel happy to see an attractive face. This is in accordance with the capability of attractive faces to capture greater attention and people appear to be motivated to look at them where even a new-born baby also tends to look longer at attractive faces (Nakamura, Arai & Kawabata, 2017). Attractive faces can be characterized with cuteness (Kou, Xie, & Bi, 2020; Rhodes, 2006). Cute faces grab people's attention and stimulate positive affective states that influences motivation approach (Karreman & Riem, 2020). In general, cuteness is very much seen on the faces of babies as well as the faces of adults. However, the effectiveness of cuteness on the face of pedagogical agents remains unknown.

Interestingly, cuteness is becoming a 'dominant aesthetic of the digital culture and consumer culture of the current century' (Dale, 2016a). Recently, the trend of cuteness is blooming in popularity as it is applied in all things, products and so on. The existence of cuteness can be clearly seen in modern Japanese aesthetic of *kawaii* which

is now widely recognized and used (Angeljimenez, 2021; Sloan, 2015). *Kawaii* aesthetics has stretched beyond the borders of Japan and today it has been practiced in numerous countries for the manufacturing of various products (Lieber-Milo & Nittono, 2019a).

Sanrio is one of the most famous Japanese companies that produce *kawaii* products since their establishment in 1962 (Lieber-Milo & Nittono, 2019b). There are more than 450-character brands and 3000 products that are exported across the globe by the company (Lieber-Milo & Nittono, 2019b). These include cute stationeries, stuffed animals, cartoon toiletries, bags and other accessories (Duman, 2020; Granot, Alejandro, & Russell, 2014). As *kawaii* is treated favourably, it is capable to induce positive affective states and consequently influence the subsequent behaviour of the people (Lieber-Milo & Nittono, 2019a; Nittono, Fukushima, Yano & Moriya, 2012; Sherman, Haidt & Coan, 2009). In this sense, the cute aesthetic qualities in the *kawaii* products generate positive affective feelings among customers that motivate them into buying it (Dale, 2016b; Lieber-Milo & Nittono, 2019b). Therefore, the question that surfaces is how would students' affective states be if the famous *kawaii* style is adapted in the design of pedagogical agent for educational environments? Besides, the adaptation of *kawaii* style in the design of pedagogical agent is a novel idea where it may affect students positively in VLE as well.

The concept of *kawaii* can be expanded with the baby schema theory (Lieber-Milo & Nittono, 2019b). According to Lorenz (1943), any object with certain facial features such as high forehead, big eyes, an oversized head and full cheeks are capable to trigger positive affective feelings among viewers (Lieber-Milo & Nittono, 2019b).

This is called as baby-schema theory. Animated *kawaii* characters that comprise visual characteristics of baby schema have gained enormous popularity and generated economic effects of millions of dollars such as Hello Kitty, Pokemon and Doraemon. The characters affect millions of viewers around the world. The global success of these characters came because of emotional reaction in humans against the power of cuteness (Marcus, Kurosu, Ma & Hashizume, 2017). Accordingly, question surfaces again from this phenomenon that how would students' affective states be now when the *kawaii*-style pedagogical agent is designed with baby schema for educational environments? Recognizing *kawaii*-style pedagogical agent with baby-schema design is absolutely fundamental for educational environments.

Taking these questions into consideration, it is essential to conduct research for developing different *kawaii* designs for pedagogical agents that believable to the students and consequently stimulate students' positive affective states to increase motivation in learning. Subsequently, such designs can increase comfort of learning in VLE.

1.2 Research Background

Animated virtual characters are virtual life-like characters that play roles as good conversational partners in animations, movies and cartoons (Hayes-Roth & Doyle, 1998; Liu, Chen & Chang, 2019). In the same way, pedagogical agents are animated virtual characters that play human instructional roles in educational environments (Saadatzi, Pennington, Welch, Graham & Scott, 2017; Vicneas & Ahmad Zamzuri,

2019, 2020). Towards the advancement of computer technology and communication, human learning is becoming more advanced through the application of technologies such as pedagogical agents (Baylor & Kim, 2005; Kim & Baylor, 2016). Pedagogical agents are widely used in various teaching and learning environment with many different roles such as mentors, motivators, facilitators, navigators and collaboration assistants (Martha & Santoso, 2019).

A pedagogical agent that is rendered on a computer screen is capable of facilitating learning of the presented material (Allessio, 2020; Gulz, 2004; Heidig & Clarebout, 2011; Veletsianos & Russell, 2014) and guide the students throughout the learning process (Clark & Mayer, 2003; Grivokostopoulou, Kovas & Perikos, 2020; Moreno & Mayer, 1999). In addition, pedagogical agents can also provide support and feedback to the students (Dinçer & Doğanay, 2017; Siti Salwah, Normala & Zarinah, 2007). Pedagogical agent can be designed to be effective learning companion to enhance students' motivation to participate actively in the learning process and enhance their learning experience as well (Hayasi & Marutschke, 2015). Apparently, students' identification with pedagogical agent is central to how students experience their Virtual Learning Environment (VLE). It seems clear that pedagogical agents play particularly important role in their social interactions with students.

When an appealing pedagogical agent is presented in VLE, students can experience student-centred learning and they would emotionally connect to the agent (Dinçer & Doğanay, 2017; Moreno et al., 2001). Thus, a strong bond will be formed between students and pedagogical agent that is likeable to them. Consequently, students feel comfort and joy in interacting with pedagogical agent. In this sense, students will

enjoy their own learning and they will be more enthusiastic to learn the presented material (Dinçer & Doğanay, 2017; Moreno et al., 2001). In such way, students' academic success and their performance can be enhanced significantly (Hong, Chen & Lan, 2014; Lin, Ginns, Wang & Zhang, 2020). Obviously, the usage of pedagogical agent in VLE is a great way to promote students' interest in learning content and their overall learning engagement (Park, 2018).

Basically, every character requires attention as it affects throughout its usage (Withrow & Danner, 2007, pg 111). Likewise, interesting pedagogical agent is capable of holding attention and leave a memorable impression among students that improve their cognitive performance (Fabio, Caprì, Iannizzotto, Nucita & Mohammadhasani, 2019). Just as people form preliminary mental models of others when they first meet, the same process occurs when students first encounter pedagogical agents (Bergmann, Eyssel & Kopp, 2012). Notably, first impression exists as an immediate response in the first meet. The first impression can trigger students' affective states as all subsequent communications are processed through the filter of those first impressions (Bergmann et al., 2012; Biancardi, Cafaro & Pelachaud, 2017).

Students' affective responses can enable them to recognize their moods towards pedagogical agents that being presented to them such as happy, confused, frustrated, surprised or bored (Mohanty, 2016). The identification of these positive and negative affective states is very important to speed up learning process in positive way in the VLE (Kort, Riley & Picard, 2001; Mohanty, 2016). Hence, visual appearance of pedagogical agent is vital design element to capture students' attention and establish their first impression and subsequently trigger students' affective states as an important

cue to identify the effectiveness and efficiency of learning environment (Mohanty, 2016; Norman, 2007).

As pointed out earlier, pedagogical agents are interesting guides that increase motivation and allow students to use learning materials at their best (Baylor & Ryu, 2003; Dinçer & Doğanay, 2017; Domagk, 2010; Dunsworth & Atkinson, 2007; Clark & Mayer, 2003; Perez & Solomon, 2005; Mayer, Sobko & Mautone, 2003). Students that are exposed to pedagogical agent demonstrated higher motivation and deeper learning than students without an agent (Kim & Baylor, 2006; Moreno et al., 2001; Terzidou, Tsiatsos & Apostolidis, 2018). There are three effects of the increment of motivation in learning (Gulz & Haake, 2006; Schank & Neaman, 2001). Firstly, motivation affects students' participation in learning process. Secondly, motivation affects the quality of attention of the students on the learning environment. Thirdly, motivation affects the organization of students' memory. In other words, the use of animated pedagogical agent in VLE will engage students to the point that it attracts students' attention to such an extent that it improves their retention in learning process.

Along this line, students' motivation increased positively when pedagogical agent resemble the students (Bailenson, Blascovich & Guadagno, 2008; Shiban et al., 2015). Students tend to prefer pedagogical agent with same age group with them (Dinçer & Doğanay, 2017; Johnson, DiDonato & Reisslein, 2013). Moreover, learning and motivation are interrelated, and it can be enhanced by using the pedagogical agent of the same age (Schunk, 1989; Sloan, 2015; Vicneas & Ahmad Zamzuri, 2019, 2020). This is in line with the capability of human-like pedagogical agent to ensure students' interactions much smoother for various teaching and learning functions (Dehn & van

Mulken, 2000; Jafari, 2002). Moreover, pedagogical agent with real people images are the best pedagogical agent types (Dinçer & Doğanay, 2017; Rodicio & Sanchez, 2012). Usually, viewers developed more positive attitudes towards human-like agent compared to robot agent (Li, Kizilcec, Bailenson & Ju, 2016). However, pedagogical agent with too realistic look will cause the students to feel uncomfortable (Kogilathah et al., 2021; Vicneas & Ahmad Zamzuri, 2019, 2020; Zibrek, Kokkinara & McDonnell, 2018). In this case, determining how to design an appealing human-like pedagogical agent that look like students and make it impressive to them as target audience is an important part in VLE.

It is believed that rich and interesting facial look of pedagogical agent has a powerful ability to make learning more fun (Elliott, Rickel & Lester, 1999; Rickel, 2001). Hence, face is a primary tool for interaction that act as mirror to reflect identities and it is the foremost aspect of pedagogical agent's design to increase affinity between human and pedagogical agent (Seymour, Riemer & Kay, 2018; Withrow & Danner, 2007,pg 042; Vicneas, 2019). The first look at the appearance of the face is able to stimulate affective responses among people (Mayo, Lindé, Olausson, Heilig, & Morrison, 2018; Miesler, Leder & Herrmann, 2011). Notably, the "cute" looking face is very essential as audience identifies with it the most with an instinctual of "Aww".

The term "cute" reminds viewers of the famous Japanese culture which is called as *kawaii*. The most popular word of *kawaii* in Japan means cute in English (Nittono et al., 2012; Takamatsu, 2018). Other than carrying the meaning of cute, *kawaii* also emphasises on the qualities of being sweet, adorable, innocent and vulnerable in the physical appearances (Hiramoto & Wee, 2019; Kinsella, 1995; Nittono, 2016; Wong,

2017). Cuteness is a powerful motivational force that induces states of readiness to engage in social affiliation (Takamatsu, 2018). The cuteness in *kawaii* style is related to human sociality that motivates people to interact socially with the given character by priming affiliative, friendly tendencies and imbuing mental states in the entity (Nittono, 2016). In addition, *kawaii* is connected to social motivation for drawing in and remaining with preferred persons or objects as an affection towards baby-schema (Nittono, 2016).

Kawaii prevailed in inanimate objects such as desserts, fashion accessories, home decorations as well as baby animals and cartoon characters (Borgi, Cogliati-Dezza, Brelsford, Meints & Cirulli, 2014; Little, 2012; Nittono & Ihara, 2017). The world of *kawaii* design had set foot outside of Japan and influenced world-wide consumer cultural phenomenon through the production of various products with *kawaii* aesthetics (Granot et al., 2014; Lieber-Milo & Nittono, 2019b; Yano, 2013). Besides that, consumer brands such as Mini, Motorola and Volkswagen have embraced cute as design aesthetic and successfully produced a variety of products that received the best response from people around the world (Granot et al., 2014; Lieber-Milo & Nittono, 2019a). Whereas, in Malaysia, animation industries have effectively created staggering and award- winning animated movies and series with astonishing characters like Ejen Ali, Boboiboy, Upin and Ipin where all these characters are centred on their cute look with localized native look which attracted audience and thus hit the box office records. From there, question surfaces on the possibility of the same result befall in educational environments when pedagogical agent is designed in *kawaii* style? It is a research interest to identify students' affective states on *kawaii* designs of pedagogical agents.

Figure 1.1. Volkswagen New Beetle. Source: Volkswagen New Beetle (2013)

Often, the famous Japanese culture of *kawaii* is characterized by baby schema (Nittono, 2016). Infantile features such as a pug nose, big eyes, round cheeks, small chin and large curved forehead are definite as a sign of the baby schema (Lehmann, Huis in't Veld, Vingerhoets, 2013; Takamatsu, 2018). Several studies suggested that infant faces are capable to capture attention at the early stage of visual processing (Brosch, Sander & Scherer, 2007; Nittono, 2016). This has been emphasized in the baby-schema concept where it reflects the cuteness of an object. Living things with the features of baby schema are perceived as cute and tend to receive approach, nurturance, protection and caregiving behaviours from other individuals (Nittono, 2010; Wang, Mukhopadhyay & Patrick, 2017a). At the same time, there are various kinds of *kawaii* characters with baby schema that are produced and exported to many countries such Poke´mon, Doremon, Hello Kitty and so on (Duman, 2020; Nittono et al., 2012).

Pokemon is a *kawaii* character with baby schema that has successfully reached global popularity through the television show, computer games and artificial products such as Pokemon dolls (Lieber-Milo & Nittono, 2019b). Adding to this, a global revive of interest in the Pokémon world arise with the release of *Pokémon Detective Pikachu*

movie in 2019 with a worldwide gross of over $431 million (Lieber-Milo & Nittono, 2019b). The movie is the eleventh highest grossing film of 2019 and the second highest-grossing video game film adaptation of all time (Detective Pikachu, 2020). Moreover, the design of *Pokémon Detective Pikachu* in the movie is likable to the audience and praised by the movie reviewers.

Figure 1.2. Pokémon Detective Pikachu. Source: Detective Pikachu (2020)

At the same time, Hello Kitty achieved a global success where it has been penetrated in the international market (Pellitteri, 2018). Sanrio company that producing Hello Kitty reaps in approximately US$3 billion annually (Granot et al., 2014). It seems clear that *kawaii* characters with baby schema have affected the audience and leaving a lasting impression among them (Buckley, 2016; Nekaris, Campbell, Coggins, Rode & Nijman, 2013). These days, kawaii items in the current commercial centre as of now not restricted to children just however for adults too (Occhi, 2012; Wong, 2017). Individuals of any age and genders appreciate the lovable kawaii items. The

characteristic of *kawaii* with baby schema features are the key factor for the success of a cartoon or an animation production. From that point of view, question surfaces whether the same success can be achieved in education field if the pedagogical agent that used in VLE is designed in *kawaii* style with baby schema features?

Figure 1.3. Hello Kitty. Source: Hello Kitty (2014)

On the other side of the coin, cartoon characters in different countries have different styles and they are usually designed according to local people's appearance with the recognition of certain feature points (Liu et al., 2019; Lu, 2009). In addition, pedagogical agent with the same ethnic features as target audience can increase their satisfaction level (Dinçer & Doğanay, 2017; Kim & Wei, 2011; Vicneas, 2019). Moreover, when ethnicity is matched between students and pedagogical agent, they perceived the agent to be more socially attractive and trustworthy (Tärning, Silvervarg, Gulz & Haake, 2019). In quite simple terms, visual appearance of pedagogical agent that match well with students can simply attract them. Hence, it is a research issue to identify the way to develop a well-designed pedagogical agent by considering certain

feature points such as facial features, ethnic, age and gender that consequently reflect cute look that likable to the target audience.

Previously, there are several research that studied the effect of using pedagogical agent. These include the study by Grivokostopoulou et al. (2020) and Mayer and DaPra (2012) who have conducted research on the effect of animated pedagogical agents in computer-based learning. At the same time, Nye, Graesser and Hu (2014) have conducted a study on different versions of AutoTutor and have compared their effectiveness. Still, there are limited studies that focused on the design of pedagogical agents for educational environments. Although pedagogical agent is a clever idea to be used in education field to improve learning (Johnson & Lester, 2016), still there are very limited studies that focused on the design of pedagogical agents for educational environments. The visual appearance of pedagogical agent has a positive affective impact in boosting motivation among students (Martha & Santoso, 2019; Shiban et al., 2015). This effect however has not yet been convincingly proven (Heidig & Clarebout, 2011; Shiban et al., 2015). The visual appearance of pedagogical agents has been widely ignored in research on pedagogical agents (Gulz & Haake, 2006; Shiban et al., 2015). Recent studies on design of pedagogical agent (Kogilathah et al., 2019, 2021; Liew et al., 2015; Vicneas & Ahmad Zamzuri, 2019, 2020) very much related to virtual agents' realism factor and its emotion rather than focusing on designing adequate social presence of the agent. Moreover, researches were carried out to address affective states among students during learning process still in early stage (Mohanty, 2016).

Hence, design related question on the look of pedagogical agent will occur in the development of pedagogical agent for VLE. Present study fills that gap by developing different *kawaii* designs for pedagogical agents to exhibit appealing visual appearance with the ability to trigger students' affective states and consequently enhance their motivation in learning. Moreover, adding the Japanese concept of *kawaii* for the research on pedagogical agents' designs will contribute to a fuller understanding on the extent of the cuteness of the agents is responsible in education system. Also, the different *kawaii* designs of pedagogical agents serve as the focal point to stimulate affective attributes that enhance emotional communication.

For that reason, two specific design decisions have been decided as experimental items to identify its effect on students' affective states and it will be implemented in VLE to identify students' motivation level throughout the learning process.

The two prototypes are as follows:

1. *Kawaii* pedagogical agent with baby schema

   The design of this pedagogical agent adapts cute aesthetics of *kawaii* style with baby schema features and a narrative voice.

2. *Kawaii* pedagogical agent without baby schema

   The design of this pedagogical agent adapts cute aesthetics of *kawaii* style without baby schema features and a narrative voice.

1.3 Problem Statement

Early studies provided evidence that pedagogical agent is a clever idea to use for learning purpose in educational environments (Johnson & Lester, 2016). However, a preliminary notion of what design features of pedagogical agents contributed to learning is still unclear. Among design issues that ought to be explored for pedagogical agent is the visual appearance of pedagogical agent (Gulz & Haake, 2006; Yu, 2015). However, the visual appearance of pedagogical agents has been neglected in the past researches (Gulz & Haake, 2006; Shiban et al., 2015). The pedagogical agents' faces are most commonly designed based on the imagination of the designer. Although faces have a high potential for inducing affective responses in humans (Miesler et al., 2011; Schirmer & Adolphs, 2017), a lack of cuteness in the design features prevents effective communication. Notably, there is no expansive study about the effect of cuteness in the design of pedagogical agent for educational environments. With this in mind, present study would bridge the gap by focusing on the cuteness in the visual appearance of pedagogical agent.

Interestingly, the appreciation of cuteness is widely seen in Japanese cute culture of *kawaii*. Beside cuteness, the broader psychological concept of *kawaii* is exclusively associated with infantility in baby schema as well (Nittono,2016). Lieber-Milo and Nittono (2019b) found that any objects that are cute with baby schema features capable to trigger positive affective feelings among people. Accordingly, a variety of *kawaii* products and *kawaii* characters successfully received best response from people around the globe. The existence of successful *kawaii* characters are mostly found in games, cartoons, movies and animations. Audiences from all age group

ranging from children to adults preferentially watch *kawaii* characters in these digital contents (Occhi, 2012; Wong, 2017). However, the obvious success that is found in these *kawaii* products and *kawaii* characters due to the stimulation of positive affective feelings among people has not yet been proven in the development of pedagogical agents in *kawaii* designs for educational environments. Hence, question surfaces if the same effects will befall on students when pedagogical agent developed in different *kawaii* designs for education purposes.

If the different *kawaii* designs of pedagogical agents is capable of making a good first visual impression, students will likely be enticed by it and stay focused. However, a major challenge for designing the pedagogical agents is to make it capable of stimulating positive affective states among students and motivate students to participate actively in learning. Based on this observation, the present study fills that gap by identifying students' affective states on different *kawaii* designs of pedagogical agent to trigger their motivation in learning.

1.4 Significance of the Study

Recently, technological advances have given greater opportunities to use animated pedagogical agents as instructional guide in Virtual Learning Environment (VLE). Animated pedagogical agent is a humanlike computerized character that designed specifically to facilitate teaching and learning in educational environments (Craig, Gholson & Driscoll, 2002; Davis, Vincent & Wan, 2021; Hong et al., 2014; Martha & Santoso, 2019).

Designers often use their own ideas to develop a character with low-level visual details such as colours, layouts and background without envisioning the overarching experiences that are possible in a design. Failure in producing a meaningful character might lead to a disruption in a whole user experience to target audience. Thus, research related to pedagogical agent's design is very essential to elicit maximum effectiveness among students in teaching and learning environment. While the use of pedagogical agent in education is still a growing phenomenon, it is still unclear on the effect of design features of the pedagogical agent in learning application. Moreover, the positive impact of cuteness in pedagogical agent has not been shown in educational environments.

Therefore, an idea aroused to introduce *kawaii*-style as an important design approach compared to approaches previously used in pedagogical agents' design. Pedagogical agent that reflects *kawaii* design is a new dimension in teaching and learning. An appropriate *kawaii* design of pedagogical agent capable to provide positive effect on learners' interactive experience. Accordingly, an initiative formed to develop different *kawaii* designs of pedagogical agents to play instructional role in teaching and learning environment.

The introduction of likeable, interesting, attractive and cute *kawaii* designs of pedagogical agents capable to solicit more attention from the students and influence their affective states. As pedagogical agents play an important role as instructional guide, it is feasible to communicate with students throughout the learning process. The social interaction between the pedagogical agents and students is an important stimulus to motivate students to participate actively in learning process. Subsequently, students

will be enthusiastic to learn independently. At the same time, it can also enable the practice of students' centred learning among students. This capable to bridge the gap between education and instructional design need to enhance students' learning experience.

Besides that, the implementation of different *kawaii* designs for pedagogical agents in VLE is a new tactic in educational environments. Understanding the importance of applying appropriate *kawaii* design of pedagogical agent will help educational technologists in preparing for the advantage of the next generation of teaching and learning environments. Therefore, this research will propose to Ministry of Higher Education, an alternative and efficient way to deliver VLE using appropriate *kawaii* design of pedagogical agent that can improve students' affective states and consequently their motivation to participate actively in learning process. Also, this research is expected to give a new dimension on the choice of pedagogical agent to be used in the production of any other VLE as well such as quiz, game-based learning, intelligent tutoring system, advertising and so on, which were previously only explored in the animated film industry, cartoons and games.

In addition, the finding of the research will provide specific clues in the design of pedagogical agents for educational environments. Specifically, the application of facial visual style to the pedagogical agents such as colour, shape, appearance and texture capable to be a set of recommendation towards the development of pedagogical agents more accurately and consistently. Thus, the research findings are expected to be a design guideline to the instructional multimedia designer to develop appropriate facial designs for animated pedagogical agents. The design guideline allows the instructional

multimedia designer to develop animated pedagogical agents for any other VLE more quickly without spending additional time to decide on the design principles.

1.5 Research Objectives

This research examines the relation between two different physical cues characteristic designs of animated pedagogical agents and motivation in learning in Virtual Learning Environment (VLE) among students in higher education institution of Malaysia. Therefore, this research measures polytechnic students' affective states on the animated pedagogical agents. Accordingly, the specific objectives of this study are as follows:

a) To analyse the polytechnic students' affective states on *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema.

b) To analyse the polytechnic students' motivation level in Virtual Learning Environment (VLE) using *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema.

c) To analyse whether the affective states caused by *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema are significant mediators in determining students' motivation level in Virtual Learning Environment (VLE).

1.6 Research Questions

a) Is there any significant difference in the polytechnic students' affective states on *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema?

b) Is there any significant difference in the polytechnic students' motivation level in Virtual Learning Environment (VLE) using *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema?

c) Are the affective states caused by *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema significant mediators in determining polytechnic students' motivation level in Virtual Learning Environment (VLE)?

1.7 Hypothesis

Ha1. There will be significant difference in the polytechnic students' affective states on *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema.

Ha2. There will be significant difference in the polytechnic students' motivation level in Virtual Learning Environment (VLE) using *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema

Ha3. Affective states caused by *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema are significant mediators in determining polytechnic students' motivation level in Virtual Learning Environment (VLE).

1.8 Conceptual Framework

Pedagogical agents are widely implemented to inspire students participate actively in multimedia learning environment. Appealing design of pedagogical agent is essential to raise students' interest and boost their affective states. However, the design of pedagogical agent remains as the most complex issue (Yu, 2015). The concern on how to design a pedagogical agent is of a great importance in the study about pedagogical agent. As for the detailed design of a pedagogical agent, there are many factors that need to be taken into consideration.

Based on previous studies, Heidig and Clarebout (2011) have developed a model about the design of pedagogical agent which is known as Pedagogical Agents-Levels of Design (PALD) model. Based on the PALD model, there are three different level for the design features of pedagogical agent. The three levels are inclusive of global design level, medium design level and detail design level. According to the global design level in PALD model, pedagogical agents can be designed as animated human characters. Technical decisions and the choice of pedagogical agent are included under medium design level of PALD model. The visual appearance of pedagogical agent is influenced by many factors of technical decisions.

On the other hand, there are three approaches to guide decisions on the choice of the pedagogical agent. The three approaches include determining features to the pedagogical agent, aiming at a specific role and applying role models for pedagogical agent. At the same time, detail design level is the highest level in designing pedagogical agent. In general, most influential factors for the decisions on detail level of the design of pedagogical agents are age, gender, clothing and so on. From the point of PALD model, design decisions that have taken on a higher level of the model presuppose the design decisions of the lower level. Therefore, the proposed conceptual framework of the present study is developed based on the PALD model.

In addition, the visual appearance of a pedagogical agent serves as the most vital aspect of designing that determines the effectiveness of the agent (Yu, 2015). The appealing visual appearance of pedagogical agent is related to the stimulation of affective states and in turn promote motivation in learning. In view of that, cuteness can be described as an appealing physical visual appearance that engage social behaviours including companionship, cooperative action and communication through affective attributes (Dale, 2016a). The cuteness of *kawaii* style with the features of youthfulness and childlikeness is a popular aesthetic style in Japanese media among all age (Occhi, 2012; Wong, 2017). Basically, *kawaii* can be defined as affective individual experience (Lieber-Milo & Nittono, 2019a; Nittono, 2010).

In 2016, Nittono introduced a two-layer model of *kawaii* which is a framework to understand about the key concept of *kawaii* from a behavioural science perspective. According to Nittono (2016), *kawaii* is viewed as a psychological state indirectly induced by the perception of certain attributes of a stimulus and the cognitive appraisal

of the relationship between the person and the stimulus. In other words, this model postulates that the basis of *kawaii* is linked to social motivation for engaging and staying with preferable persons or objects as an affection towards baby-schema (Nittono, 2016). Baby schema is one of the central elements that elicits the feelings of *kawaii* (Nittono, 2016). In addition, other attributes such as smile, roundness and colour are powerful factors that may elicit the feelings of *kawaii*.

In this model, *kawaii* is viewed as emotion which can be characterized as positive, unthreatened, moderately aroused, approach-motivated and socially oriented. *Kawaii* has three aspects or manifestations: subjective feelings, behaviour and physiology. *Kawaii* feeling is known to be associated with subjective, behavioural and physiological changes. Therefore, it is important to develop different *kawaii* designs of pedagogical agent to identify the level of affective states among students. In view of that, the two-layer model of *kawaii* is also used as a guideline to develop conceptual framework for the present study.

The conceptual framework that is proposed for the present study serves as foundation to develop two different *kawaii* designs of pedagogical agents and it demonstrates the relationship between the two different *kawaii* designs of pedagogical agents, students' affective states and their motivation in learning in Virtual Learning Environment (VLE).

The conceptual framework consists of five important elements:

1. Two different *kawaii* designs of pedagogical agents
2. Basic element of visual arts

3. External factors based on target audience
4. Positive and negative affective states
5. Motivation in learning in Virtual Learning Environment (VLE)

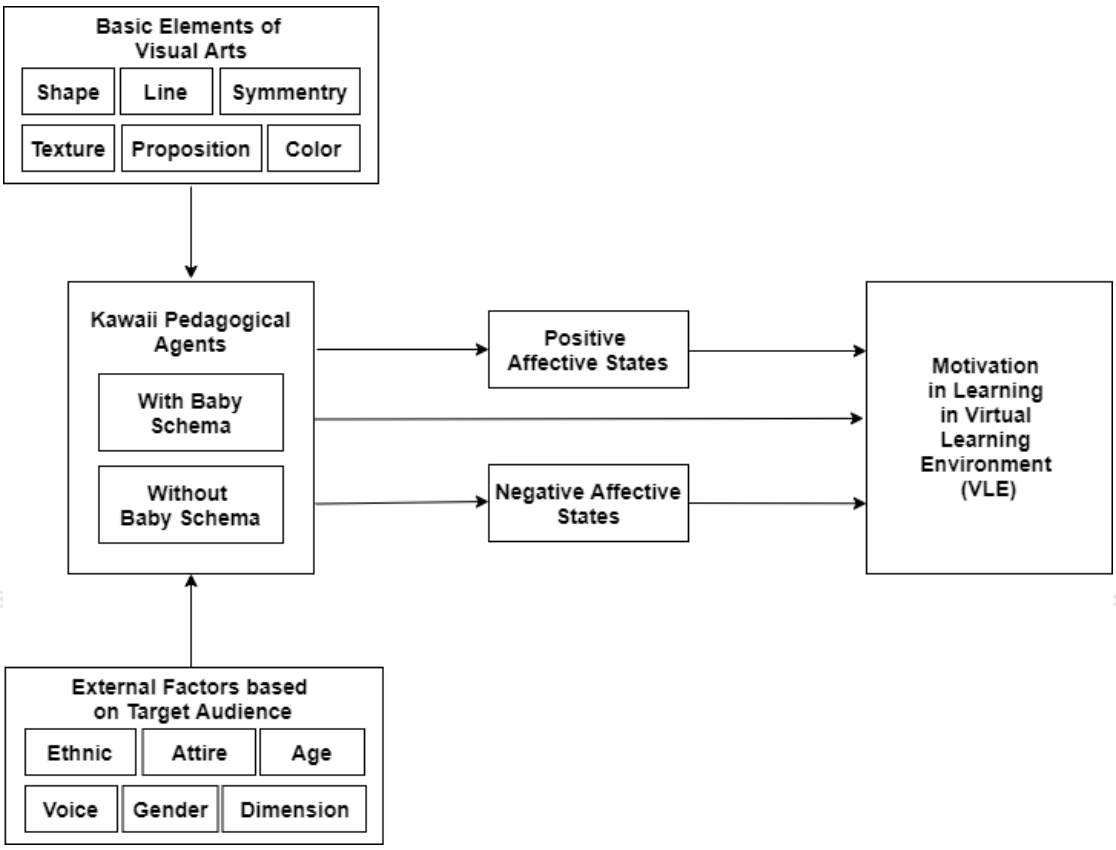

Figure 1.4. Proposed Research Conceptual Framework

Based on the proposed framework, there are two animated two-dimensional (2D) female pedagogical agents with different *kawaii* designs to play human instructional roles in VLE. The two different *kawaii* designs of pedagogical agents are known as *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema. Both pedagogical agents have different facial appearance with different cuteness aspects based on baby schema features.

The basic element of visual arts determines the extent to which cuteness is applied to the pedagogical agents especially shape and proportion. Among the shapes that focus to design the facial characteristics of the pedagogical agents are including eyes, eyebrows, nose, cheeks, lips, chin, forehead and head. Each of the shapes is in a different proportion size. In other words, the *kawaii* pedagogical agent with baby schema can demonstrate *kawaii*ness and babyishness in the facial appearance while *kawaii* pedagogical agent without baby schema can represent *kawaii* look in the facial appearance. Moreover, other elements such as colour, line, symmetry and texture are also considered in the development of the pedagogical agents.

In addition, there are some external factors of target audience that influence the design of pedagogical agents such as attire, age, voice, gender, dimension and ethnic. Students as target audience will be positively affected when each physical features of pedagogical agents match with them. Hence, the development of the two different *kawaii* designs of pedagogical agents are ensured to match with the target audience. However, question surfaces whether the development of the two different *kawaii* designs of pedagogical agents could serve as the focal point to stimulate affective states among students in higher education institutions in Malaysia? As a response to this question, the present study capable to rate polytechnic students' affective states during the first look at the two different *kawaii* designs of pedagogical agents.

Affective states can be defined as the rising of internal mood that linked to one's attention (White, 2015). Watson and Tellegen (1985) developed a model on the structure of affect. Based on the model, there are two affective states namely positive affect and negative affect. Hence, the evaluation of polytechnic students' affective

states towards the two different *kawaii* designs of pedagogical agents identified based on the model of affect.

Adding to this, the affective states are capable of triggering students' motivation in learning in VLE. In view of that, the designed pedagogical agents implemented in VLE to deliver learning materials. Here, students' motivation level evaluated in order to identify whether they are motivated or not throughout the learning process in VLE. In 1987, Keller developed a model called ARCS model of motivational design. According to Keller's ARCS model of motivational design, motivation can be seen from four factors namely attention, relevance, confidence and satisfaction (Chang, Hu, Chiang & Lugmayr, 2020).

In other words, students are considered to have been motivated and they are engaged to continue learning when a design attract their attention, it relevant to them, the students confident with it and they feel satisfied after complete using it (Khan, Johnston & Ophoff, 2019). Hence, the evaluation of polytechnic students' motivation in learning in the VLE identified based on the ARCS model of motivational design.

1.9 Limitations

This research is limited on some important areas such as research field, participants and the choice of pedagogical agent. These include:

a) This research only focuses on physical cues characteristic designs of animated pedagogical agents and its effect on polytechnic students' affective states and their motivation. There is no focus on the course content that is presented by the pedagogical agents.

b) This research is conducted on polytechnic students from four Malaysian polytechnics out of 13. The students are generally between the ages of 19 to 23 without focusing specifically to any ethnic group.

c) The research focuses on two different physical cues characteristic designs of pedagogical agents namely *kawaii* pedagogical agent with baby schema and *kawaii* pedagogical agent without baby schema. The designs cover from head to chest of the pedagogical agents and it mainly focuses on the faces of the pedagogical agents.

d) The pedagogical agents that are developed for this research is a female agent with Malaysian's native look and localized female voice.

1.10 Definition of Terms

1. Affective states

   This term refers to the feeling of a human that stimulates in response to their experience.

2. Baby schema

   A set of infantile physical features such as large head, round face and big eyes that induces cuteness perception.

3. *Kawaii*

   Kawaii is one of the most frequently used Japanese word that refers to items, humans and non-humans that are charming, cute and childlike.

4. Pedagogical Agent

   An animated human-like character that provides interactive teaching in a virtual learning environment.

5. Virtual learning environment

   Virtual learning environment is a collection of teaching and learning tools that are designed to enhance students' online learning experience.

1.11 Summary

Pedagogical agent is a lifelike character that is presented on computer screen to support learning process. The idea of using animated pedagogical agent in educational environments is expanding widely in recent years. Although animated pedagogical agents have had a good progress in academic research, an appropriate facial feature of animated pedagogical agent is yet to be determined for learning purposes. Deciding on the right feature is specially important to control the affective states of students in order to influence their learning. This in turn would impact the motivation of students in learning. Hence, present research focuses on the development of different *kawaii* designs of pedagogical agents for teaching and learning environment. The features of the different *kawaii* design of pedagogical agents selected in accordance to physical cues that characterize *kawaii* with baby schema and *kawaii* without baby schema. Although, the features lead to explore expressiveness, communication, and interactivity, question surfaces whether the different *kawaii* designs of pedagogical agents can stimulate affective states of students in learning? The finding of this research is able to introduce the appropriate *kawaii* design of pedagogical agent as an important design approach compared to the approaches previously used in pedagogical agent's design and its feasibility to stimulate affective states among students in higher education institutions in Malaysia and consequently their motivation in learning.