The Development of an English Course Using Assistive Technology to Enhance ADHD Students' English Reading Comprehension, Creativity and Self-efficacy

Nittaya Sanguanngam[1] and Kesinee Srirat[2]

[1]Asst. Prof. Dr. [2]Lecturer at Department of Business English, Faculty of Humanities and Social Sciences, Chiang Mai Rajabhat University

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Abstract

This study aimed to develop an English course for students with ADHD with the help of assistive technologies in Chiang Mai Rajabhat University Demonstration School. The course was designed based on a needs analysis and relying on other relevant and pertinent literatures. The objectives of the study were to identify the components of an English course, and to evaluate its effectiveness in enhancing learners' English reading comprehension, creativity and self-efficacy. The two main phases in this study were the course development itself and the assessment of the course's effectiveness. For the development phase, a needs analysis was conducted, and relevant literatures were reviewed, analyzed and synthesized. The instruments for the needs analysis consisted of a documentary study along with semi-structured interviews with students with ADHD at Chiang Mai Rajabhat University Demonstration School. These interviews were also extended to the students' parents and their teachers. The main study was then conducted with 5 ADHD students in fourth and fifth grades, who studied at Chiang Mai Rajabhat University Demonstration School. Both quantitative and qualitative data were collected for the course evaluation. Instruments for the quantitative analysis were an English reading comprehension test, a visualized composition task along with a student self-efficacy questionnaire. Furthermore, the instruments for the qualitative analysis consisted of a teacher's fieldnote. The quantitative data were then analyzed for means of descriptive statistics and paired-sample t-test using SPSS, while the qualitative data were analyzed through content analysis using the HyperRESEARCH computer program. The results of the study revealed that the course contents, consisting of interactive storytelling through audio-visual applications and a task-based language learning tool with fun drawing applications, proved to be

effective in enhancing the English skills of this group of students. It is noteworthy that some key features of behavioral interventions and physical learning environment were also applied in the process of this research. The results indicated that learners' English reading comprehension significantly improved, and that the learners' scored higher in creativity with their visualized composition tasks. Moreover, the learners' self-efficacy appeared to have improved when compared with the average. The outcomes of this study suggest that this course was indeed effective in terms of serving the needs of the students with ADHD at Chiang Mai Rajabhat University Demonstration School. The guidelines and recommendations in this research may prove to be effective and ought to be considered to assist ADHD students, their parents and respective teachers in similar context.

Keywords: Students with ADHD, Creativity, Self-efficacy

1. Introduction

Today, the world population is challenged by various factors including those changes caused by socio-economic and environmental conditions along with increased level of toxic elements that the occupants of this planet absorb, encounter or ingest on a daily basis, which in turn impact both their physical conditions and mental health. Obviously, these health-related issues effect all aspects of people's lives in a fundamental and often in an adverse manner. Furthermore, there is a long list of diseases and disorders that are caused by these natural or unnatural factors. A particular disorder, which is the focus of this research, is ADHD or Hyperactive Attention-Deficit Hyperactivity Disorder. This study concentrates on ADHD in education and its negative impact on students' learning capabilities. ADHD is a deficiency in the functioning of the brain that results in a number of symptoms (Levy et al., 1997). These symptoms lead to behavioral abnormalities in terms of lacking concentration and organized thoughts, and as well contribute to the absence of patience. Students with ADHD cannot truly focus on anything for a long time and lose control, showing signs of distraction and unusual behavior. They are unable to study, and distract their classmates by expressing themselves in inappropriate ways. According to Forness and

Kavale (2001), students' academic success is often dependent on their ability to attend to tasks and to classroom's expectations following their teacher's instructions with minimal distraction. Such requirement enables them to obtain necessary information, complete assignments and to participate in classroom activities, which in turn enhance their learning achievements.

Currently, the prevalence of ADHD patients in Thailand is relatively small, however, this is likely to surge with the increasing number of ADHD patients in years to come. The Department of 'Mental Health Promotion' of the Ministry of Public Health had stated that Thai students suffer from ADHD at a rate of 8.1% or an estimated 1 million students (Ministry of Public Health, 2013). The symptoms of this disorder are worrisome and will affect the future of Thai children. However, there is a misperception or lack of knowledge amongst both teachers and parents pertaining to this issue. They still do not realize the significance of this disorder and do not fully understand its implications. They often perceive that the symptoms are caused by stubbornness or disobedience, which could likely be due to lack of attention and warmth in the family. The general belief is that these adverse reactions gradually diminish and finally disappear as students mature over time (Visanuyothin et al, 2013). Because of these misperceptions and insufficient knowledge about ADHD, teachers, families and friends often perceive learners with ADHD symptoms to be a source of social problems and often react to them negatively, which results in great suffering and depression in this group of learners and in leading unhappy lives now and in the future. Moreover, this may lead to more aggressive behavior and the tendency to hurt others, and in some cases, it may result in drug abuse to relieve the suffering.

In general, the practice of care to assist patients with such symptoms includes counseling to adjust their lifestyle and to prescribe medication in case of those with

more severe symptoms. The counseling method does not seem to be effective as asking patients to adjust and exhibit normal behavior is rather unproductive and may further aggravate the situation as patients are often unable to control the symptoms of their disorder**.** Students with ADHD are often recognized once in school, where their symptoms become more apparent and often result in failing grades. Having said this, 30-40% of ADHD students' unwanted symptoms disappear when they reach adulthood, and they may be able to stop taking medications to remedy the signs of this disorder. (Barkley,1997). It is fair to state that entering school may be a turning point for ADHD students, where their symptoms become apparent. If students with ADHD are not treated in an empathetic and supportive environment, which caters their learning styles and preferences, they will greatly suffer and their learning achievements and self-efficacy will ultimately suffer. Moreover**,** if teachers do not understand the symptoms of this particular disorder, students may repeatedly accept the blame for their behavior in front of classmates. As such, teachers and educators should realize the severity of the problem and its significance in order to implement appropriate methods of teaching to facilitate the learning of ADHD learners and to improve the quality of their lives.

Many ADHD students fail in school. This may be attributed to unsuitable teaching methods, learning activities and environment. It is important to note that the instructional system in most schools has been designed for regular students, and they are not prepared to meet the learning needs of ADHD students. ADHD students are often placed in the same classroom with regular students and experience the same methods of teaching (Trankasombat, 2541). By becoming exposed to unsuitable environments and to stressful and unproductive teaching methods, students with ADHD may develop even more aggressive behavior and low self-esteem, which may further result in undesirable outcomes associated with long-term societal issues. Thus, schools and teachers can play a key role in identifying and supporting students with ADHD. To

fulfill this important premise, it is imperative for teachers to have a deep understanding and explicit knowledge of ADHD so to effectively participate in the process of teaching and learning, and to be an integral part in educating and treating children with ADHD.

The World Health Organization (WHO) is concerned about misconceptions and unawareness surrounding ADHD. Unless ADHD students are treated and educated properly, they may display a higher risk of experiencing behavioral and educational difficulties in school. Furthermore, this may have a negative impact on their educational performances, which will frequently persist in the future and may adversely impact their adulthood. The challenge is thus to develop the potentiality in ADHD students over the long run with the help of well-designed and appropriate educational programs. This includes managing the classroom in accordance with the learning styles and needs of ADHD students, which will help affected students to experience productive and successful learning. Although ADHD symptoms can cause severe impairments, many learners with ADHD can concentrate on new things that meet their interests (Jenson, 2000). Provided that students learn through creative multimedia and digital tools (Parker, 2000; Appelbaum, & US Department of Education; 2008) in a suitable learning environment, they may be able to learn effectively, and such learning environment may enhance their creativity and quality of life. Students with ADHD have a short attention span and are easily distracted, and deficits in their work have been found to be closely associated both with low academic achievements and memorization, which are common amongst ADHD students with attention problems and they are typical factors in children with ADHD (Gathercole et al., 2008). According to the U.S. Department of Education (2008), assistive technology can be a helpful tool for both adults and children with ADHD, whether those symptoms include inattentiveness, hyperactivity or impulsive behavior, or a combination of both (inattentive hyperactive ADHD). In its simplest form, assistive technology for ADHD refers to any technology (software,

hardware or devices) that can be used to assist an individual with ADHD to perform tasks that are generally difficult to initiate, complete or even remember to pursue.

These technologies attempt to coordinate tasks into instructive practices so to encourage learning for students of all capacities. As more specialized features are being offered, students with disability are increasingly able to interact with their classroom, and teachers are increasingly able to make use of the content for varying students based on their needs or preferences. Moreover, new technologies use various educational applications that are specifically designed for students with disabilities. These tools emerge on a regular basis and are developed by researchers, curriculum developers, teachers, parents and even by students themselves. These emerging educational applications have become effective options and are increasingly utilized in instructional systems (Schiller,1996). Devices and applications, when used properly, may help combat issues relating to lack of focus and may assist ADHD students to stay engaged with their work. Furthermore, younger students with ADHD may benefit from tools that teach fundamental skills. Examples of digital apps that have been recognized and received high ratings include: “Starfall, Cool Math, ABC Mouse, Brain Pop and Fun Brain”. Older students may benefit from applications that support study skills. Some good examples include: “The Chemical Touch, World Atlas, Graphing Calculator and AccelaStudy” for foreign language study. These digital tools can help students to stay on task, improve focus by reminding them to turn in their work and by creating a higher level of productivity (Namahoe, 2016). With a convenient access to the Internet and through self-access, it is definitely beneficial for younger generation of learners to make use of their learning preferences and to take advantage of vast online resources to foster their success in learning and to gain necessary 21st century skills so that they can live and work happily in the future. In order to realize and understand the diversity of generational perspectives, preferences and outlooks should be considered to help

activate effective learning experiences and to bring about more meaningful and productive learning processes. As a result of the constant and tools offered by digital and mobile technologies, today's students are self-educators and online information experts. This important aspect of learning and the value that assistive technologies could offer students with ADHD were therefore used as a foundation for this research. This study focused on designing and building a platform for ADHD students to improve their English skills with the help of assistive technologies to meet the specific needs of this particular group of students, and to investigate its effectiveness on students' learning achievements, creativity and self-efficacy.

2. Methodology

The present study has two main objectives: 1) to develop an English course using assistive technologies for ADHD students at Chiang Mai Rajabhat University Demonstration School, which relied on relevant literatures and a needs analysis for its design; and 2) to evaluate the effectiveness of the course by investigating the learning achievements of the students, their creativity and self-efficacy. The students in the needs analysis were 5 ADHD students in primary school along with their parents and 3 respective teachers. The main study started at the end of the second semester of 2018 academic year. The total number hours were 36, which were spread over 2 consecutive weeks. As mentioned earlier, there were two main parts in this study: the course development and implementation, and the course evaluation.

2.1 Course development

In order to develop this particular course, pertinent and relevant literatures were investigated and reviewed. A needs analysis was then conducted and subsequently, the course was developed based on the information obtained from the two aforementioned sources. The details are described below:

2.1.1 Needs analysis

A needs analysis was conducted to obtain information about the needs of the students to better understand their learning styles and preferences and in order to design appropriate academic instructional practices and activities. Furthermore, concepts in behavioral interventions and physical learning environment were also considered in the process. The instruments used for these purposes were a documentary study and semi-structured interviews.

1. The documentary study was done to investigate relevant information relating to the subject matter, including: common ADHD learning styles and preferences, key competencies, appropriate teaching materials and teaching support; as well as concepts in behavioral interventions, physical learning environment, and various academic instructional practices and activities.

2. Semi-structured interviews were conducted with 5 primary-level ADHD students who attended the course with their parents, along with 3 respective teachers who taught the students on site during the time this study was conducted. The semi-structure interviews were done to investigate the students' learning styles and preferences and to design appropriate learning materials together with relevant academic instructional practices and activities.

2.1.2 Course development

An English course was ultimately developed, which used assistive technology as a tool for learning. Furthermore, task-based language learning was the underlying principle in designing this teaching method. It is noteworthy that the content of the lessons and the course materials and activities as well as the assessment's components were all designed mainly based on the needs analysis.

The developed course and all the instruments were validated by three experts in the field. Subsequently, a pedagogical task was piloted for 12 hours over

three consecutive days with 1 other ADHD student, who was in the same grade (Grade 5) but not among the 5 students in the main study. The course was then adjusted to reflect the experts' comments and suggestions after the pilot study.

2.2 Course implementation and evaluation

The course was then implemented with 5 ADHD students in fourth and fifth grades for 36 hours over 2 weeks. To evaluate the effectiveness of the developed course, both qualitatively and quantitatively, a number of instruments were used so to investigate the students' learning improvement, creativity and self-efficacy. The instruments used in the process and their timing are summarized below:

1. An English reading comprehension test was administered before and after the course implementation to quantitatively evaluate the students' learning improvement.

2. The students' visualized composition tasks were used to assess the students' creativity using 'creativity rubrics'.

3. The students' self-efficacy questionnaire and the teachers' fieldnotes were used to evaluate the students' self-efficacy.

3. Results

3.1 Course development

3.1.1 Mapping of the result of the findings of the need analysis, to find course components

The results of needs analysis were mapped to obtain the components to be incorporated into the developed course as shown in the Table 1 below.

Table1: The course components drawn from mapping results of the findings of the needs analysis.

The English for ADHD students using a task-based approach The course content (From needs analysis)	
Content	- Short reading story
Teaching and learning activities (From needs analysis)	
Materials	- Audio-visual applications with interactive storytelling inputs - Interactive media, video - Mobile applications: iPad, smart phone - Application of Atlas Mission, Matilda, and Four Season, Sand Draw, My Story
Learning activities	- Reading comprehension Easy task-based learning, Writing and drawing task
Behavioral interventions	- Provide opportunities to take breaks, physical exercise and movement and get refreshed - Breaks between study sessions - Carefully structure
Physical learning environment	- Reduce class noise and distraction - Allocate enough space for students to move about or sort through resources - Provide adequate learning facilities and time needed by an individual - Provide a quiet room
Evaluation practice	- Pre-test and post-test - Questionnaire - Observation - Interview

3.1.2 The final product of an English course

The final product in this study was an English course, which used assistive technology and other components as outlined below:

1. Course content

The content of the course consisted of 3 interactive storytelling using audio-visual applications, namely: “Matilda In Australia by Atlas Mission

Application", "If I could touch the sky by StarfallFun To Read Application", and "Four Seasons by Four Seasons Application", which met the requirements obtained from the needs analysis. The stories presented general content and stories that were aligned with school children's interests. The selected stories were sequenced according to their complexity in a spiral manner.

2. Teaching and learning activities

2.1 Materials for the course

The materials for this course were 'input-providing' materials which contain special characteristics to enable learners to notice the language and interact with the story's content. These materials were comprehensible and meaningful to learners, and they presented an interactive storytelling in their specific context and were expected to activate the learners' language curiosity.

2.2 Teaching methodology

The underlying methodology used for this course was task-based language learning. The framework for the task-based lessons covered pre-task, task cycle and the language focus. At the pre-task stage, the very first phase, students were explicitly introduced to the vocabulary and language that they might use in the interactive storytelling portion of the application. In the task-cycle stage, students performed similar visualized composition tasks using provided applications such as SandDraw, My Story and Puppet Wshop. Finally, in the language focus stage, the teacher explained the problematic features of the language to the learners.

2.3 Students' evaluation

The evaluation part of the course focused on the learners' reading comprehension test. Moreover, the students' visualized composition tasks were used to assess students' creativity, whereas the students' self-efficacy was evaluated by a questionnaire and the teachers' fieldnotes.

3.2 Course evaluation

3.2.1 Students' learning achievements

The result of the *t-test* was '-11.000' which indicates that the students in the study had higher scores in their English reading comprehension post-test at a significant level ($p < .05$). In addition, the t-value of each scale from the paired-sample t-test indicates that the students' post-test scores in English reading comprehension, on average, were significantly higher than their pre-test scores ($p < 0.05$).

3.2.2 Students' creativity

The *t-test* result of '-4.427' indicates that the students in the study had higher scores in creativity during their visualized composition task performances at a significant level ($p < .05$). The t-value of each scale from the paired-sample t-test indicates that the students' post-test scores in creativity for their visualized composition task performances, on average, were significantly higher than their pre-test scores ($p < 0.05$).

3.2.3 Students' self-efficacy

The results from the analysis of the students' self-efficacy questionnaires indicates that the students showed an average self-efficacy level of 3.98, which is higher than the average value (>2.80/4.0), respectively. The t-value of '9.888' from the one–sample t-test indicates that the value (3.98) obtained from the questionnaire, on average, was significantly higher than the determined average value (>2.80/4.0). In addition, the results of the students' self-efficacy analysis from the teachers' fieldnotes indicates that all the students gradually showed higher self-efficacy during the study sessions after the first week of the study. Hence, all these results indicate significant improvement in the students' English reading comprehension, creativity and self-efficacy, thereby demonstrating the effectiveness of the course.

4. Discussion

The present study demonstrated how an English course with assistive technologies can be developed based on literature review and a needs analysis. Some distinguishing features of the study which have contributed to the course development and to the students' improvement with their English reading comprehension, creativity and self-efficacy are discussed below:

1. The audio-visual interactive storytelling using mobile and visualized composition applications were suitable for this new course. This English course with assistive technology was developed based on the literature review and the needs analysis. The underpinning theories and principles of input and task-based approach together with the needs analysis were incorporated to construct the course framework yielding the relevant and effective course components. The course was designed for a particular group of ADHD students in Chiang Mai Demonstration School, whose English proficiency level was low. As stated earlier, this group of students found themselves in a difficult position and in an environment unprepared to deal with ADHD students. Therefore, this course was designed as a way to truly foster the English reading comprehension, creativity and self- efficacy of the learners. The course components were carefully selected and designed based on the underpinning theories and the needs analysis. The researcher carefully selected the input and the materials used in the course with meaningful interactive storytelling using mobile applications. These inputs provided the students a greater exposure to the English language and to the content that was aligned with the students' abilities and English competency levels. Authentic materials used in this study were carefully selected and a course was developed based on effective comprehensible inputs to stimulate the recipients' skills. These input-providing materials were carefully selected and adjusted to fit the students' level of proficiency and their needs to serve the goals of learning. The course content and activities in this course were graded according to the complexity of the stories and

were designed as such to motivate the learners as much as possible. Furthermore, individual activities and tasks reinforced each other and were developed as such to enhance the students' learning achievements in a spiral manner. Moreover, the tasks in this course were both input-based and output-based. The students were exposed to the inputs with audio-visual interactive storytelling and did consciousness raising activities, which activated their consciousness about the language (including vocabulary and pronunciation). Such tasks were effective both for the purpose of practicing reading and listening comprehension, and as a means for presenting new linguistic materials to the students (Ellis, 2003). The students then completed the closed tasks with similar topics and made use of both their own resources and the materials they had been exposed to. The consciousness-raising activities also included corrective feedback.

2. There was a discrepancy between the information obtained from the literature review and the target group of ADHD students' learning styles and preferences.

a) ADHD students with individual interests and preferences may not conform to the needs of the group's work**.** The impact of language learning applications can be different for each learner. According to the teachers' fieldnotes, it could be observed that each student focused on their own areas of interest and on particular learning materials and applications. For example, a girl in this study loved animals so she mainly focused on animals and flowers in her visualized composition task, while another boy concentrated on his favorite strange and frightening creatures that he had been visually exposed to. According to the differences in preferences, each individual student spent most their time on his or her assigned tasks rather than choosing to work in a group.

b) According to the literature review, ADHD students must be provided opportunities to take breaks, have physical exercises and movements, and to get

refreshed. Thus, sufficient breaks between study sessions should be provided. However, the students in this study did not seem to be interested in breaks between sessions, and they spent their time enjoying the media provided in the applications to finish their tasks. The behavior of two particular students confirmed this hypothesis. They refused to take any breaks and worked through their tasks using their preferred media attached to the applications.

3. ADHD students may need longer time to finish their assigned tasks. The ADHD students in this study seemed to prefer learning with interactive applications. They showed interest in exploring the distinguishing items and features available in the application. Accordingly, they spent more time to finish their visualized composition tasks and did not want to leave until they finished their work.

4. The ADHD students in this study expressed themselves in a violent and unpleasant manner. This could be observed from the students' drawing task performances. Three out of five students demonstrated this unusual and violent behavior. Two students drew people with sharp weapons in a fighting scene; one character was drawn with cuts and scratches on the body. There was even a person depicted who was committing suicide pointing a weapon to himself. The other drawing contained pictures of a schoolgirl and a boy in search of a magic artifact to protect people from dangerous creatures. Also, some of the visualized compositions contained a scene expressing feelings and perception towards unpleasant environments. According to the teachers' fieldnotes, all students loved violent stories and often produced curse words at each other. The situation suggested the influence of undesirable circumstances that they might have faced in or out of the school environment.

5. Kind support and showing intimacy towards the teacher contributed to ADHD students' self-efficacy. The ADHD students in this study had critical low self-efficacy. Based on the teacher's fieldnotes, during the first week, most of the students

hardly made eye contact or interacted with their teachers. They stated that they were forced to join the class and actually did not want to be there. One student did not produce even one word to friends or the teacher in the first week. This student rested her chin on the table and only stared. Another boy had always his back and responded with a “No” to the teacher. All of the students only showed interest in playing and watching clips on the Internet. The teachers attempted to apply a kind and supporting gesture to provide intimacy and trust. The teachers often tapped on the students’ shoulders and hugged them from time to time, and had politely asked them for their effort to learn and finish the tasks. This approach had worked at the end, and the students started trusting the teachers more in the latter week. They started speaking and interacting more with each other and with their teachers. They also placed more efforts in their tasks and cooperated in the activities in the second week of their learning. Surprisingly, they negotiated to divide the final learning materials into smaller parts. They explained that they were special students and could not handle larger parts which were tiring to them. They also negotiated with their teachers to cover the unfinished portions of their work on the following day. The other surprising factor was that most of them expressed their sadness on the last day of learning and requested to have more days of class.

5. Implication

According to the literature review and the needs analysis, ADHD students have different learning styles and preferences. They learn well with smaller volume of learning materials that cater to their personal interests. As discussed, the relevant learning tools should include interactive media, video and learning applications. They prefer digital tools rather than handwritten materials and information presented in a non-written format. They learn well in a non-distracting environment with space for

them to move about or sort through resources. Providing adequate time is necessary for ADHD students to complete tasks. However, many ADHD students in Thailand have been placed in the mainstream of educational system with regular students in a class of more than 40 students. This inappropriate situation certainly affects their learning achievements and self-efficacy, which in turn impacts their mutuality and ways of life. The following guidelines would thus be of value for managing ADHD students. A well-designed curriculum should include: a) individual study plans based on ADHD student's individual choices and preferences, b) different courses in various subjects according to each student's individual choices, c) no longer offer a grade structure to relief students' stress, d) increase learners' curiosity and motivation to learn by emphasizing on student's self- assessment, e) education designed based on the abilities and interests of such students, and f) project work and creative thinking curricula. In terms of teaching and learning, they should include: a) information and technology-based learning, b) innate curiosity focus, c) self-direction, d) offering interesting challenges and problems. And finally, for learning assessment, a greater emphasis should be placed on project work and creative thinking, and focus should be on self- assessment with no grade structure to alleviate pressure on this particular group of students.

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