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Authentic Design Thinking for Special Education Teachers: Two Case Studies with a Special Focus on Autism

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Abstract*: Design thinking is a useful analytic tool that special education (SpEd) teachers can use to solve challenges they encounter in their daily work. It has five phases: discovery (how to approach a challenge), interpretation (how to interpret the challenge), ideation (what idea can be created to tackle the challenge), experimentation (how to use the idea to tackle the challenge) and evolution (how to evolve the idea and improve it). When the word "authentic" is added to the term design thinking, the original definition of design thinking has been extended and changed. It becomes a creative process that provides SpEd teachers a sense of confidence which they can involve in creating a more desirable future as well as taking action in face of a difficult challenge during their work. It helps SpEd teachers to design meaningful solutions to deal with their challenges ranging in scope and scale from curriculum to physical space and resources to processes and systems and to address problems in classroom, throughout the school and even across an entire district. It engages SpEd teachers in opportunities to experiment, create and prototype models, gather feedback, and redesign their lessons to enhance their students' learning and/or behaviour.*
Keywords – *Authentic Design Thinking, Autism, Learning, Special Needs, Teaching.*

I. Introduction

Education, in its broadest sense, can be described as "the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to the next with formative impact on the mind, character and physical ability of an individual and by which the individual learns" (p.30) [1]. It consists of teaching and learning – two sides of the same coin we call "education". When taking teaching and learning as a single unit to constitute the entity of education, the term teaching-learning or learning-teaching (used interchangeably) is preferred and will be used to mean the same thing throughout this chapter.

When the focus is shifted from the general education offered in mainstream schools to education for those with moderate to profound learning and behavioural challenges in special schools, the word special is added to the term education: special education. Special education (SpEd for short) refers to the formal practice of educating such students in a way that best addresses their individual differences, challenges and needs. It still involves teaching and learning. Ideally, the process of special education includes programs that are customized to meet individual needs with systematically monitored teaching procedures that may employ assistive technology, which includes adapted equipment and materials (basing on the principles of Universal Usability), as well as accessible settings (basing on the principles of Universal Design) to help these students with special needs to unlock their un-actualized potential through scaffolding when encountered a given task that presents too much of a challenge to accomplish and move gradually to as close as possible to realize their actualized potential [2]. The difference between what a student can do without help and what he/she can do with help is known as zone of proximal development [3].

According to the Individuals with Disabilities Education Act of 2004 [4] in the United States, SpEd is defined as a specially designed instruction aims to cater to the learning and behavioural needs of a child with a disability at no cost to his/her parents. It includes the provision of additional support services, customized programs, specialized placements and least restrictive environments to ensure that such students' learning and behavioural needs are being provided for. There are many students with moderate to profound disabilities whose needs are best addressed through SpEd. The range of SpEd support and service will vary based on level of supported need required as well as educational jurisdictions. Moreover, each country, state or educational jurisdiction has different policies, rules, regulations and legislation that govern what SpEd is. In Singapore, students with mild disabilities attend mainstream schools together with their non-disabled peers with additional help provided by the allied educators for learning and behaviour support (AEDLBS for short). Those with moderate to profound disabilities attend SpEd schools where additional specialized resources are allocated for use in teaching, classes are often smaller (i.e., smaller teacher-student ratio), and more attention can be given to every student, to list three examples here. In this paper, the authors' focus is targeted on SpEd.

II. The Sped Teacher And The Learner With Special Needs

At the heart of the teaching-learning process in SpEd are two key persons: the SpEd teacher and the learner with special needs. The success of teaching or intervention depends how a lesson is designed and taught in a way that best meets the learning and behavioural needs of the students with special needs.

According to Chia [5], there are three important inter-playing factors that SpEd teachers should be aware when they are teaching or working with their students with special needs: the approach, its appropriateness and its applicability (see Figure 1). Chia and Chia [6] have called it the Triple-A Model of Success in SpEd Initiative Programme

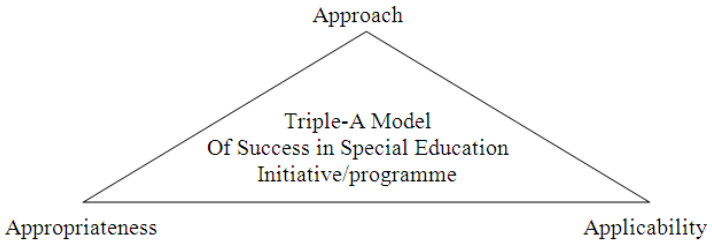

Figure 1. The Triple-A Model of Success in Special Education Initiative/Programme

According to Chia [5], the success of the approach carried out by SpEd teachers and/or any AEDLBS to teach and/or help individuals with special needs (as well as their families) to learn and acquire essential content knowledge and functional skills will depend on following three key elements (see p.21) [5]:

- Involvement of a trans-disciplinary collaboration among the SpEd teachers and other allied professionals (e.g., AEDLBS, psychologists, speech therapists, occupational therapists, social workers, and counsellors);
- Use of multi-sensory strategies (i.e., involving all the exteroceptive senses of sight, hearing, touch, taste and smell); and
- Incorporation of the Universal Design for Learning (UDL1) and Living (UDL2) (see [7] for detail) as well as transition between both.

Next, the approach of teaching or intervention must be appropriate in terms of the content knowledge and essential skills to be taught by SpEd teachers [5].

Lastly, the applicability of the approach should consider the following two elements (p.21) [5]:

- Intensity which involves consistency, frequency and duration; and
- Delivery, which should be systematic and structured so that learners with special needs can benefit from the programme.

However, the success of teaching or intervention also depends heavily on the learners with special needs in terms of three important learning factors: the capacity (inborn), the ability (acquired), and the capability (level of performance in learning) (see Figure 2). The capacity concerns the learner's potential basing on his/her inborn characteristics (e.g., cognitive, socio-emotional and personality traits), while the ability refers to the learner's possession of the means or skill to acquire content knowledge and skills. Both capacity to learn (i.e., spontaneous learning by oneself without help from others) and ability to learn (i.e., deliberate learning by being taught by others) affect the capability to learning, which refers to the learner's level of performance in learning. For example, a child with global developmental delay is able to learn but his capability of learning will be limited very much by his capacity to learn.

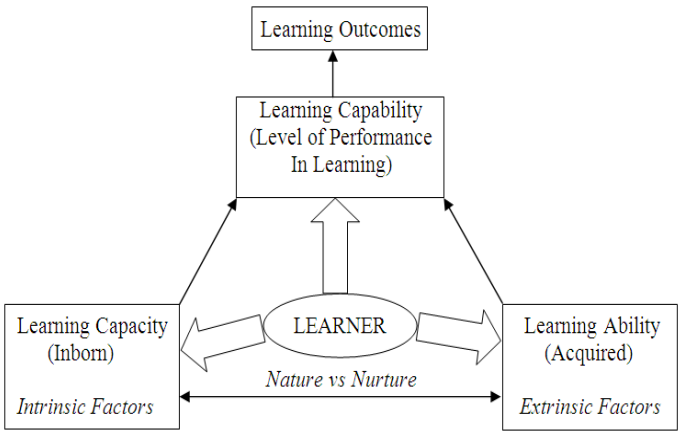

Figure 2. Learner's Capacity, Ability and Capability to learn

2.1 Macro- and micro-perspectives on teaching-learning process

Whether it is general or special education, there are two levels of perspective on teaching-learning process. At the level of macro-perspective, teaching facilitates learning and learning prepares for future employability and further development. This teaching-learning process is seen as a continuous development that grows and changes throughout an individual's lifetime: from birth to old age. This process has been divided into four progressive phases: antegogy/autogogy (birth to 6 years old)→pedagogy (6 years to 24 years)→andragogy (21 years-60 years)→gerontogogy (60 years and above) (see [1] for detail).

2.1.1 Macro-perspective on teaching-learning process

At the level of macro-perspective, teaching-learning/learning-teaching as a process is seen as a very complex life-long developmental activity. The professional SpEd landscape of teaching-learning/learning-teaching is changing rapidly since the beginning of the new millennium as it needs to respond to societal demands (e.g., every SpEd school is a good school so that parents need not worry that their children are not being provided the best SpEd services) and cater to socio-economic needs (e.g., preparing every student with special needs to become a more employable worker in a competitive job market). Once it is shifted down to the level of micro-perspective, the underlying dynamics of teaching-learning process operates in any given SpEd classroom context is seen very much impacted by a wide "range of contextual and situational factors, the unique blend of qualities, characteristics and experiences that shape each and every pupil, in addition to those which shape the (student) teachers themselves" (p.2-3) [8].

2.1.2 Micro-perspective on teaching-learning process

At the level of micro-perspective, teaching and learning concern more about how a SpEd teacher can become an effective professional in facilitating and imparting knowledge and skills as well as values to the learner (or student) with special needs. Often this teaching-learning process focuses on complex, interrelated sets of thoughts and actions perceived as demanding tasks that might be approached in a number of different ways [8]. Over a period of time, as SpEd teachers become more experienced, they gain pedagogical proficiency in both basic knowledge and skills of teaching. Loughran [9] argues that "the more an understanding of the relationship between teaching and learning may influence practice, and the more deliberately a teacher considers his or her actions the more difficult it is to be sure that there is one right approach to teaching, or teaching about teaching□ (p.3). This is the time when the SpEd teacher can be described as becoming more mindful [10] or more reflective (i.e., thinking about teaching) [11] [12]. However, Day [13] argues that reflection is necessary, but alone, it is insufficient for SpEd teacher professional development.

In both mainstream and SpEd schools of the twenty first century, teachers and other allied educators or professionals (e.g., school psychologists and counsellors) are constantly struggling with new policies and requirements set by the various education-related authorities, contemplating what to be included in the subject syllabuses, deciding what co-curricular programmes to be implemented, what activities of lower priority to be put aside and what main issues of concern to focus in their schools, "an understanding of the importance of reflective activity has never been more important" (p.11) [14]. SpEd teachers are expected to play the role of a facilitator of learning when working with their students "who are computer literate and who expect knowledge and information to be instantly accessible at the touch of a button, alongside those from a range of cultural and ethnic backgrounds" (p.3) [8]. Moreover, a SpEd class (even if it is a mainstream class) is never homogeneous. Hence, SpEd teachers are often expected to be able to manage all kinds of students:

- Those who are talented or gifted in a range of diverse ways such that they can become easily restless when they feel the lessons are boring;
- Those who are struggling to immerse into dynamic culture of information-communication technology;
- Those with socio-emotional behavioural challenges; and
- Those with a diverse range of special needs that require additional supports in the classroom by AEDLBS in mainstream schools.

As a result, there can never be two or more students with special needs responding to the same SpEd teacher or lesson in exactly the same way. This phenomenon is what sows the seed for the development of SpEd teachers' creativity and professional artistry in becoming effective within their own classrooms [8]. However, according to Pollard et al. [15], "[T]he creative mediation of externally developed frameworks for teaching and learning" (p.23) is really only possible from the position of professional understanding, evidence and reflection.

III. Design Thinking And Its Process

For SpEd teachers to be successful in today's dynamic and competitive world, they need to develop and use a different set of skills than were needed before to cope with challenges they encounter daily in their profession. Although mainstream school teachers are often given more opportunities to attend in-service training programmes to equip themselves with latest pedagogical knowledge and skills, more attention has also been

given to training SpEd teachers in Singapore today than before in order to empower them to help their students with special needs. Among the many skills that have been recognised as useful for the SpEd teachers, design thinking has been identified to empower them to perform well in their duties both within and outside school.

Design thinking, according to Razzouk and Shute [16], is defined as "an analytic and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback, and redesign" (p.330). SpEd teachers can use design thinking to solve challenges in their daily work, which can range in scope and scale from curriculum to physical space and resources to processes and systems, to address problems in classroom as well as throughout school or even at district level.

According to IDEO [17], design thinking process, there are five phases beginning with Discovery → Interpretation → Ideation → Experimentation → Evolution (see Figure 3), where each letter is the initial of each phase of the design thinking constitutes the acronym of the DIIEE framework. Each of these five phases is briefly elaborated below.

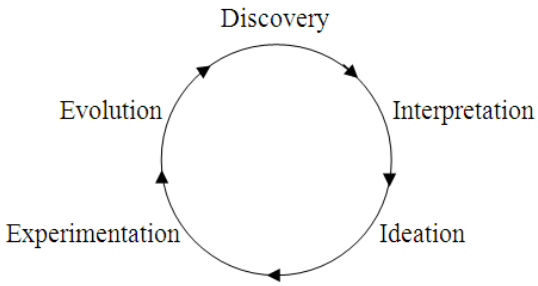

Figure 3. The DIIEE Framework of the Design Thinking Cycle

The discovery phase involves two main stages: first is to understand the challenge encountered and second is to prepare for action. The former is divided further into five steps: review the challenge, share what one knows with colleagues, work collaboratively with colleagues to build the resources needed, define the target goal to be met in order to cope or solve the challenge, and refine the plan of action. The latter is divided further into four steps: identify the challenging issue to be focused, select the target subject for focus (subject refers to the academic subject to be taught or learnt and it also refers to the learner/s to be dealt with), identify the topic to be learnt or covered in teaching, and identify the appropriate resources to be used in teaching/learning. In brief, during the discovery phase, every SpEd teacher should ask the question: "With the current challenge, how am I to approach it?"

The interpretation phase involves three main stages: first is to listen and share ideas with colleagues, and the need to know how others view the challenge/s; second is to search for meaningful learning, i.e., to find common themes to be taught/learnt, make sense of findings from the sharing with colleagues, and reconnect learning to the challenge/s; and third is to frame opportunities for learning. In brief, during the interpretation phase, the SpEd teacher should ask the question: "Now that I have learned something about the challenge, how do I interpret it?"

The ideation phase is divided into two stages: first is to generate ideas, and second is to refine ideas. Briefly, the former involves brainstorming among those involved in the design thinking process to come up with ideas to tackle the challenge/s. From the ideas gathered, the participants select promising ideas and expand the selected idea further for implementation. The latter involves description of the idea in steps for action as well as to do a reality check on the feasibility of the idea for implementation in dealing with the challenge/s. In brief, the SpEd teacher should ask the question: "Given an opportunity, what should I create to tackle the challenge?"

The experimentation phase is also divided into two stages: first is to make several prototypes of the selected idea and then decide on the best prototype to be used for a trial run and next is to demonstrate how the prototype is used. After the trial is done, a decision basing on feedback is made if it is good to be implemented in the lesson. In brief, the SpEd teacher should ask the question: "Now that I have some idea, how do I go about developing it and later to trial it?"

The evolution phase is the final one with two key stages: first is to track learning by defining what learning success is and documenting the progress made in learning; and second is to move forward in planning the next steps to enhance teaching or improve learning and it is also important to continue engaging colleagues by inviting them to participate in design thinking so as to work collaboratively to improve teaching or learning. In brief, the SpEd teacher should ask the question: "Now that the idea has been carried out, how can it be improved or evolved further to better tackle the challenge?"

Table 1 below shows the phases, stages and steps of the design thinking process, which is adapted from the IDEO model [17].

Table 1. Design Thinking Framework

PHASES	STEPS
DISCOVERY	*1.1 Understand the challenge*
	1.1.1 Review the challenge
	1.1.2 Share what one knows
	1.1.3 Build one's resources
	1.1.4 Define one's target goal
	1.1.5 Refine one's plan of action
	1.2 Prepare for action
	1.2.1 Identify the issue of focus
	1.2.2 Select the target subject for focus
	1.2.3 Identify topic to cover
	1.2.4 Identify appropriate resources
INTERPRETATION	*2.1 Listen and share ideas*
	2.1.1 How others view the challenges
	2.2 Search for meaningful learning
	2.2.1 Find common themes to cover
	2.2.2 Make sense of findings
	2.2.3 Reconnect learning to the challenges
	2.3 Frame opportunities for learning
IDEATION	*3.1 Generate ideas*
	3.1.1 Brainstorming with colleagues
	3.1.2 Selection of promising ideas
	3.1.3 Expanding the selected idea
	3.2 Refine ideas
	3.2.1 Describe the idea in steps for action
	3.2.2 Do a reality check on the feasibility
EXPERIMENTATION	*4.1 Make prototypes*
	4.1.1 Create a few prototypes
	4.1.2 Decide on the best prototype for trial
	4.1.3 Demonstrate how it is used
	4.2 Get feedback
EVOLUTION	*5.1 Track learning*
	5.1.1 Define learning success
	5.1.2 Document progress in learning
	5.2 Move forward
	5.2.1 Plan next steps
	5.2.2 Engage colleagues

IV. What Is Authentic Design Thinking?

The word authentic comes from the Greek word authentikos, which means principal or genuine, or authentēs, which refers to one who acts independently, from auto (=self) and henetēs (=a doer). When the word authentic is added to the term design thinking, the original definition of design thinking has been extended and changed. It is a creative process that provides SpEd teachers a sense of confidence so that they can be part of creating a more desirable future as well as taking action in face of a difficult challenge during their work. It helps SpEd teachers to design meaningful solutions to deal with challenges they encounter in their classrooms, at their school as well as in their community. These challenges, which SpEd teachers are confronted with, fall on a wide spectrum of scale and they are real, complex and varied. As such, SpEd teachers require new perspectives, new instruments and new approaches. The authentic design thinking is one such instrument.

By authentic design thinking (ADT), four key factors are added to it: creativity, innovativeness, imagination and uniqueness (see Figure 4). The authors of this paper have chosen to regularise the four factors by coining new words except for creativity, which remains unchanged: innovativity, imaginativity and uniquivity. Briefly, in ADT, creativity concerns with thinking new ideas; innovativity concerns about doing new tasks; uniquivity focuses on the continuum between unique ideas and unique approaches; and imaginativity focuses on the continuum between imaginative ideas and imaginative approaches.

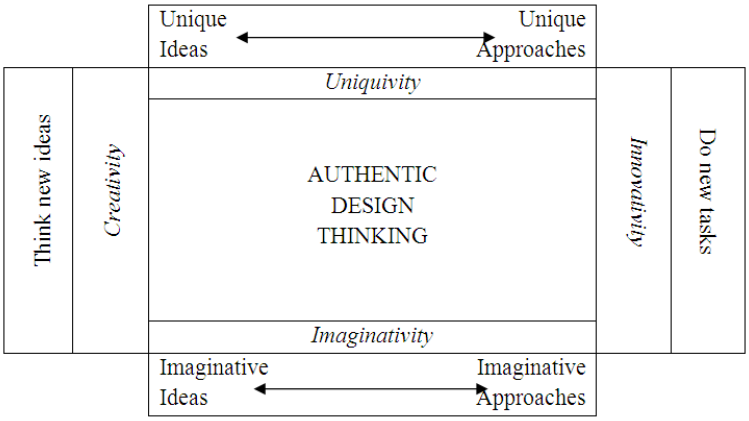

Figure 4. The Authentic Design Thinking Model

Creativity refers to "the ability to come up with new ideas, the ability to think widely, to have a free and open mind and to approach matters in a new way" (para.2) [18]. It "is about unleashing the potential of the mind to conceive new ideas" (para.3) [18]. According to Franken [19], creativity is seen as "the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others" (p.396). This suggests that creative SpEd teachers can see things and challenges they encounter daily in new ways or from a different perspective. In working or teaching learners with special needs, these SpEd teachers are able to generate new possibilities or new alternatives to solve the challenges they encounter during their teaching. There are three reasons why these SpEd teachers are motivated to be creative [19]:

- The need for novel, varied and complex stimulation;
- The need to communicate ideas and values; and
- The need to solve problems encountered.

Creativity is often confused with innovativeness or innovativity as coined by the authors. Currently, there is still no consensus on the definition or meaning of innovativeness [20]. However, according to Marshall [18], innovativeness is about introducing change into relatively stable systems and it is concerned with what is required to make an idea viable. By identifying an unrecognised challenge or an unmet learning and/or behavioural need of a student with special needs, a SpEd teacher can use innovativity to apply his/her creative resources to design an appropriate solution and reap a better result in his/her teaching on the implementation of the solution to bring about better learning in the student concerned. At the very least, innovativeness or innovativity can be defined as imprecise creation of newness. The individual innovativity of a SpEd teacher can be theoretically linked to the different ways of seeking novelty [21] or need for mental stimulation [22]. This is an important element (besides passion for the job and the compassion for individuals with special needs) in every SpEd teacher if he/she wants to stay on in the profession without suffering a burnout in the long run.

In order for SpEd teachers to employ ADT, it is necessary for them to understand ADT as "a system of overlapping spaces ... which are: inspiration, during which the problem that motivates solution-finding is identified; ideation, the process of generating and developing ideas; and implementation, the activities that enable a creative idea to move from the drawing board to the classroom" (para.8) [18] (Words in italics are added or substituted by the authors of this paper).

Using ADT, SpEd teachers "can capitalise on creativity by paying attention to the life of the idea after its initial development" (para.10) [18]. Hence, for an idea to be of value, creativity must lead to innovativity, i.e., linking a great idea with an actual learning/behavioural need of a student with special needs. The use of ADT in this way also demands the guidance of an engaged SpEd teacher's professional leadership.

Next, creativity and imagination or imaginativity (as coined by the authors) do not refer to the same thing though many may think both are one in the same [23]. The biggest difference between creativity and imaginativity is that the latter is thinking of something what is not present, while the former is doing something meaningful with one's imagination [23] [24]. Imaginativity is "the act of bringing things into conscious that aren't here" (para.1) [24]. It also refers to the ability to form new images and sensations that are not perceived through senses such as sight, hearing or other exteroceptive senses. Imaginativity helps a SpEd teacher to make knowledge applicable in solving problems and is fundamental to integrating experience and the learning process [25].

Finally, uniqueness or uniquivity as coined by the authors refers to the embodiment of characteristics being the only one of its kind. When referring to learners with special needs, the term means each and every learner is a unique individual and no two or more learners, even if they have the same disability or disorder, will

be alike in every aspect. Hence, when teaching or working with learners with special needs, SpEd teachers must plan and differentiate their lessons to meet the unique learning and behavioural needs of these learners.

The initials of the four factors – creativity, innovativity, imaginativity and uniquivity – can be put together to create CIIU columns to show how these four factors can be deployed within the ADT process, which involves DIISE phases (see Table 2). If the SpEd teacher manages to deploy the CIIU factors successfully within the ADT process at each of the five phases, a happy face (as shown in Table 2) is put in the boxes under the respective CIIU factors across each row indicating their effective deployment.

Table 2. ADT Process Model of DIISE with CIIU factors

ADT Process	Creativity (C)	Innovativeness (I)	Imaginativeness (I)	Uniqueness (U)
Discovery (D)	☺	☺	☺	☺
Interpretation (I)				
Ideation (I)				
Experimentation (E)				
Evolution (E)				

V. Application Of Authentic Design Thinking Process

Below are two case studies to illustrate how two SpEd teachers – Sonia and Jack (not their real names) – have applied the authentic design thinking process involving the five DIISE phases with the four CIIU factors. Both SpEd teachers have been working with children with autism spectrum disorder (ASD) for several years.

Autism spectrum disorder (ASD) is a neuro-developmental syndrome. It is characterised in varying degrees, by difficulties in social interaction, verbal and non-verbal communication and unusual restricted, repetitive behaviours [26].

ASD may be coupled with intellectual disability, physical health problems like sleep and gastrointestinal disturbances and challenges in motor coordination and attention span. All autism disorders were merged into one umbrella diagnosis of ASD with the May 2013 publication of the DSM-5 diagnostic manual [27].

5.1 Case Studies

5.1.1 Case Study 1: Autism Spectrum Disorder
Focus: Reading Comprehension and Motivation

The following case study illustrates how the four major factors, namely, creativity, innovativeness, imaginativeness (imagination) and uniqueness (CIIU) were considered and applied within the context of authenticity in the authentic design thinking process specifically to enhance motivation and reading comprehension outcomes.

5.1.1.1 School context

Sonia who is trained in Special Education teaches English language to twelve Primary 5 students with mild ASD in Aristotle class. The students are enrolled in an autism focused school offering Singapore mainstream curriculum. Sonia's lessons are facilitated by a support teacher, Natasha, who assists in differentiated teaching and following up on class based behaviour management interventions.

5.1.1.2 Selection of specific issue of focus

Students in Aristotle class presented classic difficulties in language acquisition, especially reading comprehension. All the twelve students possessed a wide repertoire of vocabulary knowledge acquired through their weekly spelling and dictation tasks. They could read age-appropriate texts according to their reading age but were not motivated to read.

Moreover, they displayed difficulties related to "theory of mind" concept when they were required to infer or take perspectives of the viewpoints presented in the text [28]. They were also struggling with "weak central coherence" as they were focusing on minute details in the given text instead of paying attention to the "big picture" so as to derive at answers that require inference [29].

Sonia also scrutinised the five reading components, specifically, reading experience, word reading skills, sentence reading skills, reading comprehension abilities and reading attitude [30] [31] to ascertain the focus area. She targeted to work on reading comprehension which she viewed as a pertinent skill for both academic and life.

5.1.1.3 DIIEE procedure of design thinking process

Even though Sonia was aware of the classic difficulties that students with ASD face in reading comprehension, she was determined to bring about a positive transformation. She explored how she could become a change agent through employing creativity, innovativeness, imaginativeness (imagination) and uniqueness (CIIU) in her quest to pursue the authentic design thinking process to address the problem.

Phase 1: Discovery

Students in Aristotle class will be pursuing Primary School Leaving Examination (PSLE) in 2015. In tandem with the revised national curriculum, they must be imbued with 21st century skills. Particularly, they must be able to answer inferential comprehension questions based on a variety of text on local and global events.

Sonia identified the 21st century literacy skills (i.e. creative thinking, problem solving, communication skills and collaboration skills) that she needs to impart to her students to enhance their reading comprehension. She aimed to use information literacy to facilitate her students to work effectively with varied information at all levels of Bloom's Taxonomy (remembering, understanding, applying, analysing, evaluating, and creating). Though information literacy engages traditional skills such as reading, she wanted to find new and authentic ways to impart the whole cycle of reading and ensuing reading comprehension.

Stage 1: Understand the challenge

In order to understand the challenges faced by her students in reading comprehension, Sonia read up on evidence-based studies. She discovered that many investigations reported that students with ASD, face difficulties in deriving meaning from varied texts that they read [32] [33] even when they do well in word-reading. The difficulties students face with taking perspectives, comprehending and predicting expressions or actions affect their ability to infer from a given text. This phenomenon was recorded especially in students with high functioning autism who demonstrated deficient text monitoring during reading [34].

With an insight from research, Sonia then examined the home support. An informal check with the parents and students indicated minimal home support as most of the parents were working and the students were mostly cared by grandparents and/or domestic helpers.Upon reflection, Sonia realised that she was working in isolation and not together with the other English language teachers. She wanted to explore the possibility of collaborating with the other Primary 5 teachers.

Step 1: Review the challenge

Sonia verified informally with the other Primary 5 English teachers if they faced the same problems with their students' reading comprehension. She evaluated her personal competence and experience, expertise of her peers teaching English language, available resources and school culture in terms of supporting collaborative projects.

Step 2: Share what she knows

Sonia shared her initial appraisal of her students' learning abilities, gaps in reading comprehension skills and review of her challenges with the English language coordinator and Vice Principal who was overseeing the implementation of the mainstream curriculum.

Step 3: Build her resources

She identified five building blocks of resource capacity building. They were input from students, collaboration with the school's IT department, other English subject teachers and parents and backup from the school's leaders.

Step 4: Define her target goal

The goal was to improve students' reading comprehension component scores at the end of the year's summative assessment. The complementary goal was to make a positive change in the Aristotle class students' attitude and motivation towards reading.

Step 5: Refine her plan of action

Sonia reassessed the challenges faced by her students and her preliminary plan of action. She considered the complexity, scope, school-wide priorities and the other teachers' deployment commitments.

Stage 2: Prepare for action

Sonia checked with the English language coordinator to determine if she could work on a pilot project together with the other three Primary 5 English language teachers. She received in-principle approval to pursue

the project for a 6 month period as it was recognised that the project will complement the school's reading programme. Besides, her Principal gave permission for the team to collaborate with the IT department as ICT was identified as a key enabler for the project.

Team members comprised a good mix of teachers with corporate experience, mainstream and special needs trained. Collaborating at inter and intra departmental level was a pioneer attempt by Sonia. The whole process was propelled by her desire to make an authentic change to her lesson planning to delivery cycle based on students' needs.

Step 1: Identify the issue of focus

During the 1st session with the project team, Sonia provided the overall framework and time-line for the project. Team members took turns to share about their class profiles and students' reading comprehension skills. The team decided to pilot study Aristotle class on the use of ICT to motivate students to read and in the process enhance their reading comprehension through auxiliary apps and on-line activities.

Step 2: Select the target subject for focus

It was unanimously agreed to launch the pilot study with Primary 5 English language as the target subject.

Step 3: Identify topic to cover

The team decided to focus on reading comprehension and motivation towards reading.

Step 4: Identify appropriate resources

The team affirmed the need for a paradigm shift from teacher-centred English sessions to student-centred English sessions. Students in Aristotle class were encouraged to recommend a list of books according to their personal interests. Sonia desired to promote self-advocacy and self-determination skills in her students. The books were purchased using the class budget and placed at the class library.

The IT department issued 6 iPads and 2 laptops to Aristotle class. The team proposed to use technology to harness information literacy so as to encourage the students to read from on-line materials, interactive story telling websites, and partake in on-line story quizzes to enhance their understanding of the text and learn through guided inferential quizzes.

The team reckoned that online resource, storylineonline.net, which has a whole gamut of story read by famous people, would appeal to the students. Students would be exposed to stimulating and thought-provoking original stories that would grab their interests. Through listening to good reading with expression and excellent diction, it was envisioned that students would be keen to listen, read, and improve their comprehension through answering both direct and inferential questions. Moreover, book creator app was installed in all the 6 iPads in Aristotle class.

Phase 2: Interpretation

At the next meeting, Sonia recapitulated her research findings on reading comprehension and challenges faced by her students. The team synthesized the research findings and created generative questions, such as "How might we enhance reading comprehension through facilitating critical thinking and problem-solving skills?" and "How might we provide opportunities for interest-driven learning?"

Stage 1: Listen and share ideas

The teachers shared and discussed ideas on how to promote reading, facilitate reading comprehension and enhance reading attitude of the students in the pilot study.

Step 1: How others view the challenges

The discussions enabled the teachers to gather different viewpoints and analyse issues from varied perspectives.

Stage 2: Search for meaningful learning

The team was steadfast in making learning meaningful for the students even when they had to follow the national curriculum. They acceded that learning should be fun, motivating, experiential and student centred.

Step 1: Find common themes to cover

The team decided on themes covering varied texts and context addressing self, home, school, community and global domains. These themes would provide a broad perspective for the students to acquire the identified 21st century and reading comprehension skills.

Step 2: Make sense of findings

The summative assessment scores and reading attitude of the students were discussed. The team deliberated on the importance of bridging the gaps as reading and understanding of texts are pertinent for learning, accessing information, and eventually excelling in PSLE.

Step 3: Reconnect learning to the challenges

It was validated that there was a need to imbue students with a sense of ownership towards their own learning. The team revisited the challenges faced by the students and confirmed that they had the resources and support of the school leaders to implement the intended interventions.

Stage 3: Frame opportunities for learning

The team viewed the challenges faced by students in reading comprehension as opportunities to reflect and introduce authentic, innovative and unique way of teaching reading and reading comprehension. The reading comprehension gaps provided the team a cause to celebrate as it opened doors for them to share ideas, learn from each other, stretch their imagination to look for novel ideas and be catalyst of change.

Phase 3: Ideation

Stage 1: Generate ideas

The team generated ideas on how to use space in the classroom, effective deployment of support teacher, differentiated tasks based on goals set to maximise student potential, use of ICT to facilitate reading comprehension, and how to effectively collaborate with parents.

Step 1: Brainstorming with colleagues

Specifically, the team explored different ways in which ICT could be integrated with pedagogy. The curriculum was explored further to determine how it could be connected to the students' interests and personal experiences in order to make it meaningful.

Ideas were mooted on how Sonia could transfer the ownership to actively look for information and answers to the students. The space in the classroom was discussed to ascertain how different learning centres could be set up to facilitate vicarious learning, print-rich environment and imbue 21st century skills. Ideas were generated on how parents could be fruitfully engaged to encourage their children and provide opportunities to improve on background knowledge and experiential learning.

Step 2: Selection of promising ideas

The team decided on specific strategies for each of the 21st century skills, critical thinking, problem solving, communicating, collaborating and literacy skills. Students would be guided on the aforesaid skills when working on multiple and varied reading passages both in print and on-line. They would take ownership of their learning through choice in their learning activities and have ample opportunities to collaborate, discuss, create and analyse.

Step 3: Expanding the selected idea

Next, the team explored UDL guidelines. The UDL principle of providing multiple means of representation [35] was applicable for their pilot study. The use of Book Creator app would enhance the students' information processing skills on what information they select and how they integrate new information in relation to their prior knowledge and experience. This would provide opportunities for comprehension.

Students could be introduced to digging for answers' games and 'Exploratorium' after school activities to activate their background knowledge with their parents. Parental support was garnered to provide experiential learning opportunities through weekend outings to places in the community and places of interests. Students were encouraged to write about their experiences using the Book Creator app. High ability students (HASs) were stretched to formulate questions based on the written text.

Stage 2: Refine ideas

The team re-examined the need to enhance reading comprehension and imbue 21st century skills. The study was meaningful as the ability to acquire the aforementioned skills would enable students to excel in their academic pursuit and future employment.

Step 1: Describe the idea in clear steps for action

The team captured their thoughts in writing. They named their team "Project Aristotle". The team wrote down their vision, action steps, resources, opportunities and challenges.

Step 2: Do a reality check on the feasibility

As it was a pilot study involving only twelve students, the team concluded that the project was feasible. They agreed to review and adjust accordingly throughout their 6 month duration.

Phase 4: Experimentation

Sonia and Natasha organised their students according to abilities. Those who were proficient in using technology were paired with someone less savvy. The new layout was photographed and all sessions were videotaped for feedback.

Stage 1: Make prototypes

The sequences of listening to story sessions were captured on a mind map.

Step 1: Create a prototype

As students were encouraged to take ownership of their learning, the mind-map was placed in the classroom for them to use as a reference point. Sonia referred to the mind map and interacted with her students on the salient points on the map.

Step 2: Show how it is used

Sonia captured the Reading Process Checklist as one part of the mind map. To illustrate, she had a separate post-it on guides such as 'The children choose their own reading material', 'The children discuss their personal reading in self-chosen groups (sometimes guided by discussion questions)'.

Sonia gave content overview before students listened to the online stories. Priming the background knowledge for a given reading text activated thinking process, since students gear towards linking to what they know to new data, details and information. Priming lessened students' anxiety, promoted predictability and enhanced the prospects of their success in reading comprehension [36]. She also used think-aloud strategies to assist her students to make predictions [37].

HASs who were able to use the iPad applications were paired with low ability students (LASs) in the class. Sonia explored the idea of 'cognitive apprenticeship' in this instance.

Students started their English lessons with tuning in to storylineonline.net. They were guided on interactive reading and questioning using WH probe cards. They had to role play the story which provided the freedom to express their views, personalize technology to their own tastes and collaborate. Students too innovated and progressed by reading web sites, accessing videos, evaluating Web resources and researching on the Internet. At the end of each Book Creator activity, students were encouraged to present and share to their classmates.

Stage 2: Get feedback

Feedback was sought at different levels. Team members completed a questionnaire after watching a video on Aristotle's English lesson. They commented that they noticed positive student engagement, collaboration, communication and self-directed learning.

Students wrote reflections and completed mind maps on using ICT and related apps to complete English activities. They liked the Book Creator as they felt a sense of empowerment as story writers and presenters.

Teachers provided feedback that Project Aristotle would support new teachers in assimilating to the school culture, promote buddy programmes, encourage collaborative teaching, sharing of ideas and instil a positive learning culture. They also recognised improved professional development through championing projects which provided a sense of empowerment in being catalyst of change for students' outcomes.

Sonia and Natasha too completed a self-evaluation on what worked and what could be improved.

Phase 5: Evolution

Stage 1: Track learning

All the students in Aristotle class reported increased motivation to read and create stories due to the pure mobility and convenience of the apps in the class iPads as they could easily bring the iPads and access them even during recess. They were motivated to capture their recess experiences through story writing using the Book Creator. Their learning was tracked using both formative and summative assessments.

Step 1: Define success

There was increase in confidence in all students. They were willing to share with classmates on what they have read. Three students created a book blog and invited teachers and classmates to comment on their

book reviews. With positive reinforcement from teachers, the HASs motivated the LASs to develop confidence to try new apps in the iPads.

Step 2: Document progress

Students' progress in terms of academic results, socio-emotional well-being, confidence, motivation, reading attitude, self-esteem, class participation and engagement were continuously tracked. The team celebrated every milestone and success that they attained.

Stage 2: Move forward

Project Aristotle provided the team members a safe environment with endorsement from school leaders to explore, learn from mistakes, improve and embrace a life-long learning culture. The team was ready to forge forward after experiencing success when they embraced the notion that considerable effective learning occurs outside the classroom when it is initiated and structured by students. This notion of control of learning being motivational is well-established in the motivation literature [38].

Step 1: Plan next steps

The team identified the following:

- Roll out the study to all the Primary 5 classes and possibly other levels;
- Identify a pool of reading comprehension apps that can balance students' advanced reading and decoding skills with their delayed comprehension abilities; and
- Work with the following year's teachers on transition matters and how to continue fruitful collaboration with the parents.

Step 2: Engage others

The results of the pilot study were communicated to all the school staff during staff communication session. All the information from discovery to evolution phase was uploaded in the school's shared folder for reference. The Authentic Design Thinking Process Model provided Sonia the tools and empowerment to create meaningful educational change.

Table 3 charts Sonia's quest as a positive catalyst of change agent in her school through the effective deployment of creativity, innovativity, imaginativity and uniquivity within the ADT Process Model.

Table 3. Sonia's ADT Process Chart of DIISE with CIIU factors

ADT Process	Creativity (C)	Innovativeness (I)	Imaginativeness (I)	Uniqueness (U)
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Evolution (E)	☺	☺	☺	☺

5.1.2 Case Study 2: Autism Spectrum Disorder

Focus: Narrative Writing

This second study exemplifies the major considerations and application of CIIU in order to facilitate a positive narrative writing journey.

5.1.2.1 School context

Jack made a mid-career switch from the engineering field to special education in 2012. He teaches in the same school as Sonia. Jack has completed a 3 month certificate course in autism conducted by his school. He teaches English language to fourteen Primary 5 students with moderate ASD in Beethoven class. Jack's lessons are facilitated by two support teachers, Janet and Lawrence, who assist in co-teaching and class based behaviour management interventions.

5.1.2.2 Selection of specific issue of focus

In view of the changes in the mainstream curriculum syllabus pertaining to writing, Jack had to explore ways to motivate his students to write creatively based on a given topic so that they would score well in their national assessment. However, majority of the students in Jack's class dislike writing activities. The writing demand and request to do work often translate into negative student behaviour. Even a simple writing task can

trigger a meltdown and disruptions in lesson as his students find it difficult to transfer their ideas into writing. Yet, they could write journals when the task required them to pen down reflections about their personal interest areas. Jack pondered over how to meet the educational and behavioural needs of the students in his class. He had to implement evidence-based strategies uniquely designed to meet the writing needs of his students.

Jack read about the latest research pertaining to writing for persons with ASD so as to understand the difficulties faced by his students. He found that new brain research has revealed that there are significant variances in the way the entire brain functions in persons with ASD. The key difference seems to be in the way the various areas of the brain communicate with each other. In the brain of a person with ASD, messages do not get transmitted from one section of the brain to another with the same regularity and efficiency as they do in the neuro-typical brain [39].

This deprived communication between strategic areas of the brain has a significant impact on a student's ability to write. The writing process necessitates a high level of coordination between the various parts of the brain. During the writing process, a person must stimulate the areas of the brain that regulate motor control and planning, language skills, problem solving, sensory processing, imitation skills, memory, organization, and proprioception. It has been reported that thousands of neural signals are sent back and forth throughout the brain for these activities to occur. Conversely, the brain of a person with ASD appears to send far fewer of these coordinating neural messages [40]. Hence, the resulting frustrations exhibited during the writing tasks.

Despite the challenges faced by his students, Jack understood the importance and impact of acquiring writing skills. His students would be expected to write proficiently across varied purposes and settings. Written communication transpires every facet of community, work and daily life. Proficiency in writing is also demanded by employers [41]. His students would partake in social networks which require electronic written messages such as email, texts, Face book and Twitter. Moreover, they would encounter and use a myriad of text-based tools like planners, PDA and smart phone apps.

As Jack embraced a long term vision for his students, he was passionate to imbue them with positive post school outcomes and quality of life. Jack assessed his students and found that all fourteen of them possessed an appropriate range of thematic vocabulary knowledge. Furthermore, they had a good grounding on idioms, similes and thematic phrases. This baseline knowledge of his students gave Jack a zest in his quest to help them to acquire the skills and interests in writing.

5.1.2.3 DIIEE procedure of design thinking process

Jack reckoned that he needed to examine the writing task through the lens of his students with ASD. He needed to embrace a paradigm shift in his approach and strategies to impart and facilitate writing skills. He analysed how he could become a catalyst of transformation through exploring CIIU in his pursuit to use the authentic design thinking process to address the problem.

Phase 1: Discovery

Students in Beethoven class will be sitting for the PSLE in 2015. Students must be able to complete narrative writing within forty minutes based on a given topic and three mostly unrelated pictures. Students may use one or all of the pictures to write their story.

Jack indentified that his students need to learn 3 fundamental skills in order to write effectively. They needed to acquire planning, writing and proof reading skills. His students were strong visual learners and he hoped to tap on their strength by providing laminated sheets of Figure 5 for their story planning structure.

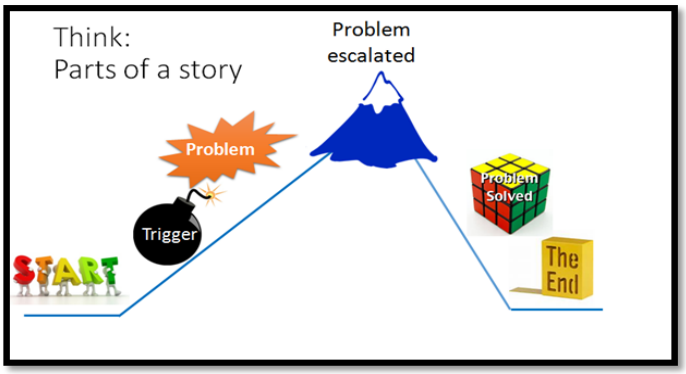

Figure 5. Story Planning Structure

Though the story planning structure engages systematic thinking process, Jack wanted to explore fresh and authentic medium to impart the whole cycle of writing.

Stage 1: Understand the challenge

In order to comprehend the struggles faced by his students in completing writing tasks further, Jack scrutinized evidence-based research articles. Regrettably, persons with ASD may have challenges in achieving positive writing skills [42] [43].The good news was that some researchers [44] [45] have reported generalised positive results in writing when computerized software packages were utilised. Other researchers [46] [47] also reported improved narrative writing skills when multi-factor intervention platform comprising assistive augmentative communication device, storyboards, story maps, and facilitation through modelling were used. Besides, Delano [48] [49] and Asaro and Saddler [50] respectively reported positive results in narrative writing skills when self-regulated approaches such as video self-modelling, preference interview methods and scaffolded instructions were used. With the understanding of the evidence-based investigations, Jack continued to examine the home support. Most of the parents provided positive home support for homework and revision. Five students had regular home tuition as well. Jack also envisaged that it would be better for him to network with fellow peers teaching the same level so that everyone could leverage on each other's experience and expertise.

Step 1: Review the challenge

Jack checked with his peers if they faced the same problems with their students' writing skills. Jack was rather keen on using some form of a writing app so as to first garner the interest of his students towards writing tasks. He evaluated the available resources and degree of support he would get if he embarked on this project.

Step 2: Share what he knows

Jack shared his initial appraisal of her students' writing skills with the English Language coordinator and Vice Principal who was overseeing the implementation of the mainstream curriculum.

Step 3: Build his resources

He gathered information on the available writing apps that he could install in the iPads provided for his students, the degree of support from his school's IT department, the willingness of his peers to embark on this project, and support from parents and school leaders. Jack decided on 'A Novel Idea' as the organisational app that he would like to implement in all the iPads provided for his students.

Step 4: Define his target goal

The goal was to improve students' writing scores at the end of the year's summative assessment. The complementary goal was to make a positive change in Beethoven class students' attitude and motivation towards writing.

Step 5: Refine his plan of action

Jack re-evaluated the difficulties faced by his students and his initial plan of action. He deliberated the complexity, extent of his impending project, school-wide priorities and his peers' deployment schedule.

Stage 2: Prepare for action

He checked with the English language coordinator to determine if he could work on a pilot project together with the other three Primary 5 English language teachers. He received in-principle approval to pursue the project for a 6 month period as it was recognised that the project would boost students' writing skills. His Principal too gave him permission to collaborate with the IT department to install the 'A Novel Idea' app in all the students' iPads. Jack formed the pilot team comprising the 3 English language teachers and an IT specialist. The team brought an extensive and blended expertise to the discussion table.

Step 1: Identify the issue of focus

During the preliminary session with the project team, Jack briefed the members regarding the project scope and time-line. The other language teachers shared that they too faced similar issues pertaining to their students' writing skills and mind-set. The team concurred to pilot study Beethovan class and assess the outcomes on writing attitude and skills of the students through the use of the 'A Novel Idea' app.

Step 2: Select the target subject for focus

It was decided to launch the pilot study with Primary 5 English language as the target subject.

Step 3: Identify topic to cover

The team opted to focus on narrative writing.

Step 4: Identify appropriate resources

The IT department issued 14 iPads to Beethovan class. The team agreed with Jack to use 'A Novel Idea' app to harness information literacy so as to encourage the students to develop an interest and flair for writing through the engaging app. The app would enable his students to brainstorm and organise ideas to assist them in their writing. With the writing 'skeleton' space available in the app, the students would be able to complete the settings, tone, theme and plot points. Besides, his students would be able to create appealing profiles of their characters by completing character traits, descriptions, conflicts and other pertinent information that would facilitate their eventual writing. As his students have a keen fascination in using iPads, Jack reckoned that he would be able to garner their interests in completing their writing activities.

Phase 2: Interpretation

At the subsequent meeting, Jack reiterated his evidence-based findings on writing skills of students with autism as well as how the studies impact and/or relate to his students' writing abilities and challenges. The team synthesized the findings from the studies and documented generative questions, such as "How might we enhance writing skills through providing a structural framework for the students to work on?" and "How might we provide opportunities for inculcating positive attitude towards writing tasks?"

Stage 1: Listen and share ideas

The teachers deliberated on varied ideas on how to encourage and boost positive attitude towards writing of the students in the pilot study.

Step 1: How others view the challenges

The constructive brainstorming sessions enabled the team to gather diverse perspectives and analyse concerns from varied standpoints.

Stage 2: Search for meaningful learning

The team was committed in making learning far-reaching and meaningful for the students despite the constraints of a given national curriculum. They unanimously agreed that learning should be stimulating and student centred.

Step 1: Find common themes to cover

The teachers agreed on themes spanning across the domains of self, home, school, community and global. These themes would provide a wide coverage for the students to acquire writing proficiencies.

Step 2: Make sense of findings

The summative assessment scores and attitude of the students towards writing were discussed. The team was steadfast on bridging the gaps as writing constituted a major component in PSLE.

Step 3: Reconnect learning to the challenges

It was authenticated that there was a need to instil the students with a sense of personal ownership towards their own learning. The team reviewed the challenges faced by the students and established that they had the resources and support of the school leaders to implement the proposed interventions.

Stage 3: Frame opportunities for learning

The team viewed the challenges faced by students in writing as opportunities to reflect and introduce authentic and creative mode of teaching narrative writing. The skill gaps provided the team an opportunity to collaborate and tap on their wide-ranging experience and expertise to infuse novel ideas and be vehicle of positive transformation in student learning.

Phase 3: Ideation

Stage 1: Generate ideas

The team generated ideas on logistics, manpower deployment for the year, school-wide pedagogical and physical structure considerations, and fruitful collaboration with parents to facilitate writing skills in students.

Step 1: Brainstorming with colleagues

Particularly, the team delved into varied ways that the writing App could be integrated in tandem with pedagogy. Besides, they studied the curriculum so as to incorporate students' interests, skill levels, prior knowledge and experiences in order to make writing exciting and purposeful.

The team discussed on how writing corners, circles, ancillary materials and support could be clearly set up, demarcated and labelled. This would enable the students to be self-directed learners, take pride in their writing and be owners of writing projects. Parental support would be garnered as students would be able to bring home the iPads on Fridays to complete journaling of weekend activities.

Step 2: Selection of promising ideas

The team decided on adopting writing strategies such as visual outlines and access to a list of thematic vocabulary words. Buddy writers circle will be formed to guide and encourage weaker writers. Generous constructive feedback will be provided with inspirational videos on writers who eventually became successful after failures. Resilience and positive attitude towards writing will be instilled. Eventually, students will be guided to move towards intrinsic motivation to write.

Step 3: Expanding the selected idea

Next, the team explored UDL guidelines. They explored how different mind-mapping tools and multimedia software (i.e. delivered within the implementation of 'A Novel Idea' App) would use UDL framework to make abstract information more concrete during the writing process.

Stage 2: Refine ideas

The team re-examined the need to enhance writing skills and imbue 21st century skills of critical thinking and resolution of problems in their stories. The study was meaningful as the ability to acquire the aforesaid skills would enable students to excel in their academic pursuit in higher institutes of learning and future careers.

Step 1: Describe the idea in clear steps for action

The team wrote the salient points in post-it pads and put up in the meeting room as a visual snapshot. They named their team "Wizard Writers Club". The team wrote down their vision, action steps, resources, opportunities and challenges.

Step 2: Do a reality check on the feasibility

As it was a pilot study involving only fourteen students, the team concluded that the project was feasible. They agreed to review and adjust accordingly throughout their 6 month duration.

Phase 4: Experimentation

Jack, Janet and Lawrence discussed about students' abilities, classroom behaviours and ancillary support in order to group the students in class. Students were arranged into four groups based on their skills in using iPad and working relationships. All sessions were videotaped for records, feedback and review.

Stage 1: Make prototypes

The writing process cycle was captured in visual form.

S

tep 1: Create a prototype

The writing process cycle was printed in A3 size and placed at the front and back of the classroom for easy reference and to promote independent learning. Jack explained the cycle in a systematic manner with ample examples so as to facilitate understanding.

Step 2: Show how it is used

Jack ascertained on how students learn to write. He built in a system of teaching writing by modelling his writing, facilitating students to practice in context, encouraging daily journal writing and writing for real purposes and audiences such as a suggestion to the school principal.

Jack explicitly taught the students on how to focus on the given topic, develop the topic and how to use details to create pictures in the reader's mind.

Students started their English lessons with tuning in to storylineonline.net. They were encouraged to focus on the introduction, body and conclusion of the stories. Trigger, escalation and problem-solving elements were explicitly discussed to promote understanding of the stories that students have heard on-line. Students were encouraged and facilitated to discuss the stories and determine the moral or lesson learnt.

Stage 2: Get feedback

Feedback was sought at different levels. Team members completed a reflection sheet after watching a video on Beethovan's English lesson. They commented about positive student participation.

Students wrote reflections on what they like or dislike about 'A Novel Idea' app. All students found the app engaging and reported positive improvement in their writing skills.

Senior Teachers provided feedback that 'The Wizard Writer's Club' project would support new English teachers in teaching writing to students with diverse learning needs and autism. Further, they commented that teachers could explore collaborative teaching and sharing of ideas. Most importantly, they appreciated the sense of empowerment and professional growth in being change agents for positive student learning and outcomes.

Jack and his team completed an 'evaluation sheet' on what worked and what needs improvement based on their experiences on working on the pilot project.

Phase 5: Evolution

Stage 1: Track learning

All the students in Beethovan class reported increased motivation to write as the "A novel idea' app was user-friendly. Besides, students could bring home the iPads to improve and modify their writing at home. Students' learning was tracked using both formative and summative assessments.

Step 1: Define success

There was increase in confidence and willingness to write in all students. They were motivated to share with classmates on what they have written. Well written submissions were typed and distributed as model answers. Students felt a sense of pride and accomplishment.

Step 2: Document progress

Students' progress in terms of academic results specifically in writing component, confidence, motivation and class participation were continuously tracked. The team celebrated every success regardless of magnitude.

Stage 2: Move forward

'The Wizard Writer's Club' project provided the team members a supportive environment to experiment, continuously improve and embrace a life-long learning culture. The team members explored best practices in teaching writing. Additionally, some members who had friends teaching in other schools networked with them to tap on their expertise and knowledge.

Step 1: Plan next steps

The team confirmed the following:

- roll out the study to all the Primary 5 and 6 classes;
- identify a pool of writing apps, mnemonic devices and graphic organizers that can assist and facilitate by providing a concrete representation; and

Step 2: Engage others

The results of the pilot study were communicated to all the school staff during staff weekly meeting. All the information from discovery to evolution phase was uploaded in the school's shared folder for reference. The Authentic Design Thinking Process Model provided Jack the tools and empowerment to create meaningful educational change.

Table 4 charts Jack's quest as a positive catalyst of change agent in his school through the effective deployment of creativity, innovativity, imaginativity and uniquivity within the ADT Process Model.

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Ideation (I)	☺	☺	☺	☺
Experimentation (E)	☺	☺	☺	☺
Evolution (E)	☺	☺	☺	☺

VI. Conclusion

In this paper, the authors have illustrated with two case studies to show the usefulness of ADT as an instructional design tool that enables Sonia and/or Jack (being analytical and creative) to function as an imagineer – a portmanteau that combines two words imagination and engineer. The term imagineer refers to someone who lets his/her imagination soar and then engineering it to tackle challenging issues of concern. In other words, ADT embraces an effective deployment of creativity, innovativeness (or innovativity), imaginativeness (or imaginativity) and uniqueness (or uniquivity) has given the two SpEd teachers a free play to experiment, develop and try out their ideas, gather constructive feedbacks from colleagues and redesign a better strategy to meet the learning and/or behavioural needs of their students with ASD.

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