Proof-of-Concept

Feed 52

A Social Integration Pilot Project for Persons with Autism with St. Andrew's Autism Centre

1. Introduction

Background

Social isolation is a pertinent problem that Persons With Autism (PWAs) experience in society. This issue is no secret. From institutions training PWAs to be career-ready by equipping them with employable skills, to multiple social enterprises taking on high numbers of special needs workers, and even the various programme schemes implemented by the Singapore government to increase the employment opportunities for PWAs,[1] many solutions to facilitate social integration are correspondingly present today. Yet over the years we also observe that social enterprises and businesses-for-good who actively try to integrate PWAs into society by providing employment are facing burnout.[2] This led us to question how far we have progressed in this inclusive society that we have envisioned.

In doing so, we identified two key problem statements:

1. Acquiring the right skills is necessary for the quality of life for PWAs (e.g., to explore their potential and their strengths, to have and maintain a job in society).
2. Public perception of PWAs is integral to the way they treat PWAs in public.

Many think that having *awareness of the needs of PWAs* and *equipping them with employable skills* is the key to facilitate social integration. However, it is not uncommon to hear of PWAs with higher support needs being excluded due to the difficulty in imparting skills to them. This then led us to think about the methods and scale of skill acquisition in this community. There is also a more complex underlying issue present: the societal perception towards PWAs. Having general awareness of an autistic individual's condition may not necessarily aid in a compassionate and reasonable perception of them to facilitate social integration. At times, awareness can even lead to an opposite outcome. For example, in a series 'Growing Up with Autism' portrayed by Straits Time,[3] we see how a girl growing up with autism still struggles to navigate 'weird stares from the public' as she displays certain actions that are considered 'abnormal'. From expressing love in a playful manner with her domestic helper that may seem a little rough, to sitting in public impolitely, this in turn causes an opposite perception towards her, even if the member of the public is well aware that she is an individual with autism. This then begs the question: Even if the autistic community are

[1] https://www.mom.gov.sg/-/media/mom/documents/budget2020/factsheet-enabling-employment-credit.pdf; https://employment.sgenable.sg/employers/open-door-programme/
[2] https://www.reuters.com/article/us-entrepreneurs-social-mentalhealth-idUSKBN1X31HV
[3] https://www.straitstimes.com/singapore/growing-up-with-autism

equipped with skills, would businesses choose to employ them as compared to a neurotypical individual?

Job training and placement agencies have provided feedback that potential employers are inclined to focus on what persons on the spectrum cannot do, instead of what they can do *i.e.,* their strengths. Some employers are also resistant to redesign jobs to better accommodate PWAs. Persons on the spectrum also report that their conditions continue to be stigmatised in society and workplaces; disclosure of their autism condition can often result in fewer callbacks for interviews. Since work options are limited, underemployment continues to be an issue even for cognitively able adults on the spectrum who have low support needs.[4]

Hence, driven by the vision of a 'new society' where the community and PWAs experience less division between them, we hypothesise that social integration for PWAs can be facilitated via a two-fold approach:

(a) **Facilitate skill acquisition through technology assistance**;
With technology supplementing the learning process, we aim to improve the learning experience for both PWAs and educators, as well as to explore greater opportunities for skill acquisition for PWAs with higher needs.

(b) **Foster familiarity of the public towards the autistic individual;**
With familiarity, an enriched relationship is present, which is distinct from merely being aware of their needs. As Dr. Stephen Shore, an autistic self-advocate and a renowned professor, once said, "If you've met one person with autism, you've met one person with autism." There is great diversity within the community, each individual having their own sets of liking, preferences, and needs. Would perception change, once someone becomes a friend, and not merely a 'Person With Autism'?

[4] *Autism Enabling Masterplan, Singapore, 2021*

What is Feed 52?

Feed 52 is part of a broader social integration initiative started by Solve n+1, called the Social Integration Project (Autism). Feed 52, in particular, refers to the series of pilot projects Solve n+1 is conducting with St Andrew's Autism Centre (SAAC). It aims to facilitate social integration for PWAs, beginning with the above-mentioned two-fold approach. Due to Covid-19 restrictions arising around the same time we conducted the pilot, we chose to focus solely on the first part of facilitating skill acquisition through the assistance of technology. This paper sets out the parameters of the pilot and is a proof of concept for Phase 1 (see Table 1 below). Though this paper focuses on Phase 1, Table 1 also covers Phase 2 and 3, which build on Phase 1, and sets out how Feed 52 is intended to develop to facilitate social integration (e.g, through volunteer engagement and community building).

Table 1: Phases of Feed 52

Phase	Details
1	**<u>Technology Integration Pilot</u>** *Incorporating Smart Kitchen Technology into Curriculum (Cooking Classes)* **Objectives** (1) Curriculum innovation aimed at increasing student engagement and improving the quality of their learning experience. ● Previously, a PWA might only be able to execute singular tasks (e.g., chop garlic). The chopped garlic is not easily edible on its own, nor valued by members of the public as a complete dish. ● Introducing the right kind of technology that can supplement the rest of the cooking procedures to produce a completed dish, can increase the student's engagement as they continue to work on their specific skill sets. ● The pilot will look at understanding the effects of technology on PWAs' learning process & skill acquisition as well. (2) Curriculum innovation aimed at facilitating curriculum goals & alleviating strain on educators. ● Previously, activity options were mostly limited to pre-made/ frozen foods (e.g., frozen prata). This posed 2 issues. First, the creativity of educators in lesson plans are limited. Second, safety

	risks associated with typical cooking tools (e.g., stoves, hot pans) were present. ● Pivoting the curriculum tools through the right technology can allow more opportunities to explore skill acquisition, as well as greater focus on skill acquisition due to the mitigation of safety factors. This also allows educators greater creativity in their lesson plans and more activity options. (3) Curriculum innovation to find the right programmes and tools that expand the quality of opportunities for interaction between PWAs and educators/volunteers. This will be the platform for future ecosystem building and facilitating social integration. ● Previously, volunteers do the majority of the work/cooking to make up for the lack of skills of PWA. The interaction is also focused on a singular task (e.g., chopping garlic). ● With this new model of utilising technology as a supplement, there is greater quality of interaction between the PWA and volunteers. For example, the right technology can allow both the PWA and volunteers to produce a variety of dishes. This deepens the interaction and the meaningfulness of the activity.
2	**<u>Social Integration Pilot Part 1</u>** *Volunteer Engagement with Technology-Integrated Programme* **Objectives:** *(Note: Phase 2 is meant to build on Phase 1)* (1) Build a network of volunteers that engage with PWAs through the newly established Technology-Integrated Programme/Curriculum. (2) Establish the rules of engagement for fostering personal familiarity between volunteers and PWAs as they interact through the newly established Technology-Integrated Programme/Curriculum. (3) Establish a more meaningful platform for fostering personal familiarity between PWAs and volunteers.
3	**<u>Social Integration Pilot Part 2</u>** *Community Engagement & Supporting Low-Income Families*

	Objectives: *(Note: Phase 3 is meant to build on Phase 2 and 3)* (1) Build a mutually dignifying relationship between PWAs and other vulnerable groups. For example, where PWAs cook to provide food for low-income households, and low-income households get to know the PWAs personally. (2) Establish the rules of engagement for building such a mutually dignifying relationship between PWAs and other vulnerable groups. (3) Establish the support needed for building such a mutually dignifying relationship between PWAs and other vulnerable groups.

2. Context

Situational Analysis

Autism in Singapore

Today, there are an estimated 50,000 persons with autism living in Singapore - constituting around 1% of the population.[5] Despite the lack of formal studies on autism in Singapore, we see increasing numbers being reported from data gathered from public hospitals. In 2014, about 4,400 children were diagnosed with developmental issues, which is a significant jump from 2,500 children in 2010. As of 2016, it is estimated that 1 in 150 children in Singapore is on the autism spectrum.[6]

Our nation has ensured holistic development paths for PWAs, providing systems and care across key areas such as lifelong learning, employment, and residential arrangements. In line with the Singapore Enabling Masterplan, we recognise that challenges still remain in various areas:

- Post-Special Education (SPED) school learning options are limited. Most SPED students stop learning, whether in daily living or for work, resulting in an enduring 'cliff effect' phenomenon after graduation.
- Lifelong learning, which is the goal of Singapore's SkillsFuture movement, is not accessible to many adults on the spectrum. Most SkillsFuture offerings do not provide the needed disability learning support.
- Limited range of work options for adults on the spectrum in Singapore due to various reasons, e.g., lack of awareness and understanding among employers, reluctance on the part of the employers to redesign jobs.
- Persons on the spectrum report that their condition continues to be stigmatised in society.
- The number of successful internships for SPED students may not be high due either to limited training and support to prepare them for internships and/or limited internship opportunities in industries.

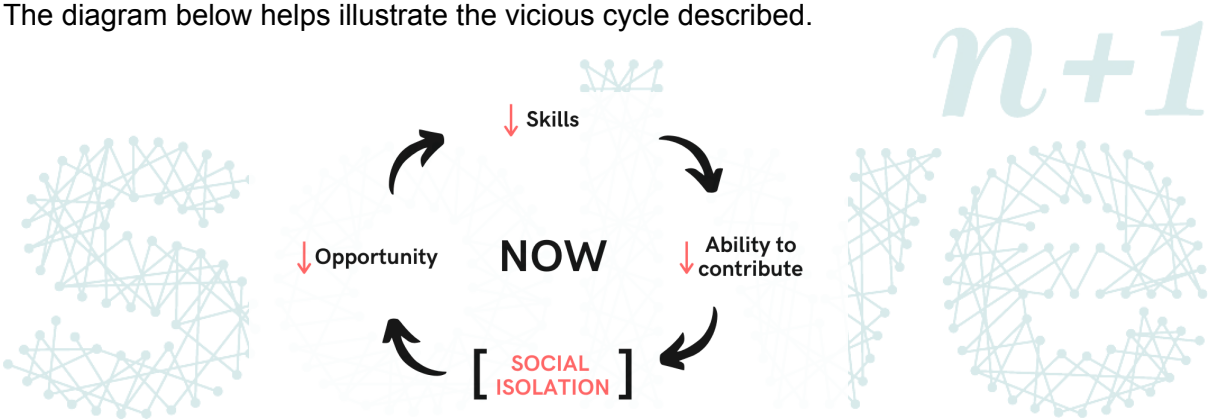
We see that apart from training and helping PWAs manage their behaviour, there is also an underlying social issue, namely - the social exclusion that the autistic community faces.

[5] https://www.healthxchange.sg/news/study-1-in-150-children-in-singapore-has-autism
[6] 3rd Enabling Masterplan Steering Committee, *3rd Enabling Masterplan 2017 – 2021: Caring Nation, Inclusive Society* (2016), p. 15.

Social exclusion can occur in various ways throughout an individual's life as they face stigmatisation from the public for certain behaviours or needs they have. Stimming behaviours or even occasional meltdowns in public might cause members of the public to feel helpless and distance themselves, as they are at a loss of what to do. For other PWAs, sensitivities to noise and light might also require very specific environments for them to learn and grow, hence excluded from the general public naturally.

This form of social exclusion affects the opportunities a PWA has access to, and it affects their daily life. Research has shown that the quality of life for people with developmental disabilities decreases when they are segregated from society and their communities.[7] A lack of opportunity also perpetuates a vicious cycle leading to social isolation through lack of skills and inability to contribute meaningfully to society. The consequence of social isolation is an increased mental strain on not only the individual but the caretaker as well.

The diagram below helps illustrate the vicious cycle described.



THE VICIOUS CYCLE

[7] Reid, Dennis H., and Marsha B. Parsons, Quality activities in center-based programs for adults with autism: Moving from nonmeaningful to meaningful, Academic Press, 2016.

Challenges & Opportunities for Innovation

Challenges Faced by PWAs

One of the major difficulties faced by PWAs is in communication. They have been noted to have difficulty processing auditory information, with visual information processing being their strongest method of receiving information.[8] They often also use atypical language to communicate, thus visual methods are the best way to communicate. Autism is also often associated with intellectual disability (ID). They often have a delay in social interaction, whether verbal or non-verbal. This often manifests as lack of interest in others, failure in empathy, resistance to changes, restricted interests, and absent or lacking language communication especially in preschool years.[9] Other possible issues include aberrant sensory perception that leads to over responsiveness, under responsiveness or paradoxical responses to stimuli.[10]

With the understanding of the challenges faced by PWAs, we turned to look at possible opportunities for innovation.

Technology In The Autism Space

As of late, there has been a rise in the use of information communication technology (ICT) via Ipad in teaching PWAs.[11] Mainly, technology has been seen to help in communication, daily life routines and motivation.[12] A meta-analysis focused on technology and autism has revealed that PWAs are good at using technology for learning. This is thought to be because of the predictable nature of technology.[13]

Food in Singapore & Autism

In Singapore, food is an aspect of our culture and lives so much so that our beloved Hawker culture has been added to the UNESCO list of intangible cultural heritage of humanity.[14] In Singapore, food naturally brings *all* people together.[15]

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[8] https://www.uptodate.com/contents/autism-spectrum-disorder-evaluation-and-diagnosis?search=autism&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1#H2709123154

[9] https://www.jaacap.org/article/S0890-8567(13)00819-8/fulltext

[10] https://pubmed.ncbi.nlm.nih.gov/10953176/ https://pubmed.ncbi.nlm.nih.gov/9242859/

[11] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5004059/

[12] https://www.autismspeaks.org/tool-kit-excerpt/how-technology-can-help

[13] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6832622/

[14] https://ich.unesco.org/en/RL/hawker-culture-in-singapore-community-dining-and-culinary-practices-in-a-multicultural-urban-context-01568

[15] https://www.straitstimes.com/singapore/closer-ties-as-neighbours-bond-over-food

Though there may be some individuals on the spectrum who have been able to cook well, such as Jeremiah Josey,[16] who is now a chef, it is likely that many PWAs will not, or cannot, follow in his footsteps. For most PWAs, safety rules and risks add further complexity to cooking and act as a further barrier to entry.[17] This is on top of cooking being extremely distressing and challenging for most PWAs,[18] because of its (1) sensory challenges, (2) fine motor control, (3) following instructions, (4) individual food aversions. As such, though places may hire PWAs (e.g. dignity kitchen, Pope Jai),[19] their contribution is often limited to waitering and cutting of vegetables.

Smart Kitchen Technology & Autism

Seeing that cooking can be used as a platform to bring people together, we want to provide both the opportunity and support required for skill acquisition. In this project, one area of support will be in the form of smart kitchen technology.

There has been a rapid increase of technology over the ages. So much so that technology that was initially meant for neurotypicals (e.g., iPads), has been modified to help PWAs. As such, our hypothesis is:

To facilitate social integration for PWAs, a two-fold approach can be adopted, involving:

(a) Facilitating skill acquisition with the assistance of technology;
(b) Changing perception towards PWAs by fostering familiarity of the public towards them.

[16] https://www.huffpost.com/entry/jeremiah-josey-baker-autism_l_605cafb9c5b67ad3871d653e
[17] https://www.autism-society.org/living-with-autism/how-the-autism-society-can-help/safe-and-sound/safety-in-the-home/
[18] https://autismawarenesscentre.com/whats-cooking-life-skills/
[19] https://projectdignity.sg/training-programme-for-special-needs/

3. Feed 52 Phase 1

Objectives

Table 2: Phase 1 of Feed 52

Phase	Details
1	**<u>Technology Integration Pilot</u>** *Incorporating Smart Kitchen Technology into Curriculum (Cooking Classes)* **Objectives** (1) Curriculum innovation aimed at increasing student engagement and improving the quality of their learning experience. ● Previously, a PWA might only be able to execute singular tasks (e.g., chop garlic). The chopped garlic is not easily edible on its own, nor valued by members of the public as a complete dish. ● Introducing the right kind of technology that can supplement the rest of the cooking procedures to produce a completed dish, can increase the student's engagement as they continue to work on their specific skill sets. ● The pilot will look at understanding the effects of technology on PWAs' learning process & skill acquisition as well. (2) Curriculum innovation aimed at facilitating curriculum goals & alleviating strain on educators. ● Previously, activity options were mostly limited to pre-made/ frozen foods (e.g., frozen prata). This posed 2 issues. First, the creativity of educators in lesson plans are limited. Second, safety risks associated with typical cooking tools (e.g., stoves, hot pans) were present. ● Pivoting the curriculum tools through the right technology can allow more opportunities to explore skill acquisition, as well as greater focus on skill acquisition due to the mitigation of safety factors. This also allows educators greater creativity in their lesson plans and more activity options. (3) Curriculum innovation to find the right programmes and tools that expand the quality of opportunities for interaction between PWAs and

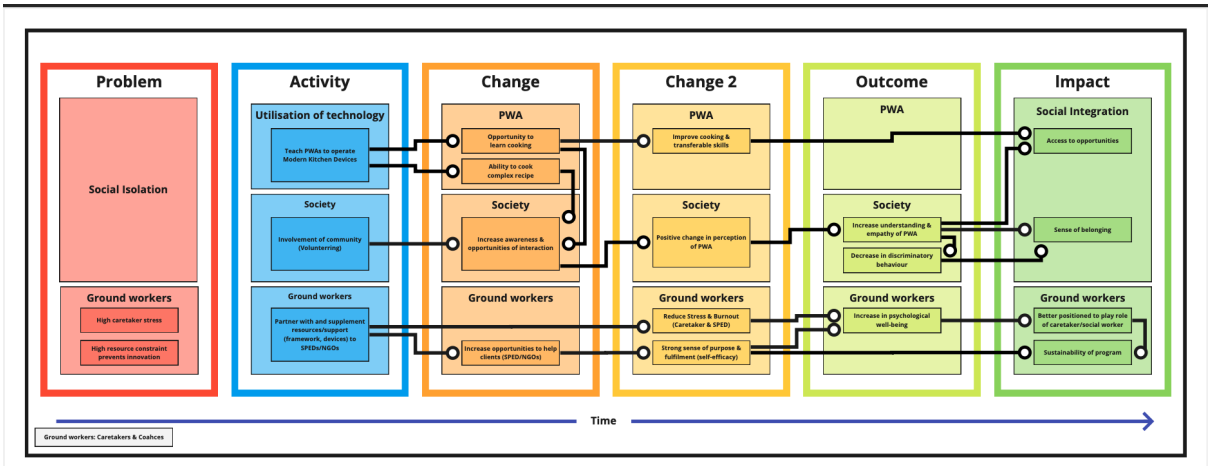
	educators/volunteers. This will be the platform for future ecosystem building and facilitating social integration. • Previously, volunteers do the majority of the work/cooking to make up for the lack of skills of PWA. The interaction is also focused on a singular task (e.g., chopping garlic). • With this new model of utilising technology as a supplement, there is greater quality of interaction between the PWA and volunteers. For example, the right technology can allow both the PWA and volunteers to produce a variety of dishes. This deepens the interaction and the meaningfulness of the activity.

Outcomes To Achieve

1. To understand the effects of technology on PWAs' learning process & skill acquisition.
2. To create a curriculum incorporating technology for skill acquisition, that institutes can implement and run with ease.
3. To create a platform for an future ecosystem where social integration can take place easily.

Theory of Change

Figure 1.1: Theory of change model



4. Project Framework

This section outlines the parameters in which Feed 52 was conducted.

Partners

We set out to find a suitable partner that could share the same vision to collaborate with us on this pilot project, and was glad to be able to work with St Andrew's Autism Centre (DAC - Sengkang) ('**SAAC**')**.** Subsequently, we were able to use their physical venue to conduct and test out the lessons with their clients.

Project Parameters

Technology of Choice

Feed 52 utilised **multi-purpose cooking appliances (MPCA)** as the technology of choice, as they have unique characteristics such as the ability to tap on a store of guided recipes, and can produce consistent results. For this specific project, we selected the Thermomix. (Refer to Appendix A for safety considerations).

We hypothesise that MPCAs can help us to supplement skills acquisition among PWAs, enabling them to cook more complex and different types of food. This can be done because of the unique characteristics of MPCAs, such as guided recipes and increased consistency of the results. It is crucial to note that we do not aim to completely replace all cooking processes performed by PWAs, but rather supplement by helping them to complete tasks that they are unable to do. We set out to see if this might encourage them to attempt more skills, with the confidence that whatever they cannot complete will be assisted with the technology.

As aforementioned, one of the benefits to using MPCAs is the ability to use guided recipes[20] that simplify the cooking process.. For example, on the Bellini Supercook, guided recipes automatically set the temperature, speed and duration required for each step of the recipe. It even tells the user what step they need to do next with the help of visual aids on the screen such as symbols. The main control panel also has 3 icons to represent temperature, speed

[20] http://www.supercook.me/en/supercook/articles/btmkm800x/

and time. Such visual aids are understood easily by both coaches and PWAs, and is especially important given that not all PWAs are literate, but are able to understand pictures or videos. Some of the steps in the guided recipes are also accompanied by a video demonstration. Visual aids can also help a PWA and their coach understand each other better, enabling more effective guidance by the coach whilst enabling PWAs to communicate their difficulties by pointing out the part they have difficulties in. Importantly, complex recipes are also broken down into easier tasks, as the user just needs to add in ingredients according to the instructions on the screen. Other MPCAs such as those from Thermomix also have similar features and we expect them to work just as well in supplementing the cooking process for PWAs.[21]

Another benefit of tapping on MPCAs is that they help to reduce variance between the results each cooking class produces, resulting in a more consistent successful product from each session. For example, one of the unique selling points of Thermomix is their "unique success guarantee".[22] Using the Thermomix reduces dependence on the cook's skills in preparing and processing ingredients, allowing for more consistent products. This can help PWAs by reducing the guesswork that is often required in cooking and turn it into something more routine, encouraging them to experiment and try out other cooking skills like measuring during the cooking process that they may not normally have the capacity to even attempt. This could also encourage them to try out more complex and difficult recipes which they may not have been able to do before.

In addition, a large collection of recipes from most brands allows for coaches to teach PWAs how to cook a wide range of food items in a simple way. The coaches may not know how to cook the dish themselves, but they can learn from the large collection of recipes and then teach their clients. They can now attempt to cook many dishes that would've been too complex for them without a MPCA, allowing them to try out many new dishes. The range of dishes increases even further with the robust range of attachments that can be used to enable more cooking methods.

Through these unique characteristics, MPCAs help optimise the skill acquisition learning process by integrating more visual cues and tool support into the kitchen. It offers them an opportunity to learn safely while having many different experiences. It increases the range of recipes the PWAs can attempt since they can explore much more complex recipes. According to our partner, SAAC, PWAs were previously only able to take on simple recipes

[21] https://Thermomix.com.sg/Thermomix/benefits/
[22] https://Thermomix.vorwerk.com/Thermomix/

such as instant mix pancakes, instant noodles or assemble sandwiches. An increase in range of products allow PWAs to work with many different kinds of food and textures, which could potentially help them overcome aberrant sensory perceptions. If successful, future work could involve trying to include this in sensory integration therapy curriculum.[23] However, this is with the understanding that sensory integration therapy is a highly debated therapeutic method.[24] In addition, by involving volunteers, cooking together with PWAs will also provide a means for social integration as we welcome PWAs into the local community.

Supplementing Current Skills

In the current context of this project, our technology of choice is aimed to empower PWAs. The role of the equipment would be to supplement the skills of PWA. A simple example would be: if a PWA is able to cut an onion into quarters but is not able to dice it, then the equipment will help to dice the onion quarters.

Target Group

The clients were chosen based on the capacity of our partner, SAAC. Trained coaches within the centre were able to use their knowledge of the classes and clients to recommend 4 suitable individuals for a start. They took into consideration factors such as the readiness of the clients and capacity of the coaches to incorporate this curriculum into their existing classes.

The profile of the chosen clients are as such:

- Mix of both genders;
- Aged 21-35 year old

Structure of Curriculum

- Weekly classes, with a duration of 2 hours
- 2 different classes
- 3 different recipes over the course of project

[23] https://www.gravitybread.com/baking/how-to-make-cooking-a-sensory-experience/
[24] https://www.sciencedirect.com/science/article/abs/pii/S1750946712000074

Considerations

Goals in Non Medical Treatment of PWAs

According to AAP guidelines,[25] the overarching goals of treatment are to maximise functioning, move the child toward independence, and improve the quality of life. Specific goals address the core deficits of ASD and seek to:

- Improve social functioning and play skills
- Improve communication skills (both functional and spontaneous)
- Improve adaptive skills
- Decrease nonfunctional or negative behaviours
- Promote academic functioning and cognition

Hence, our considerations before deciding how to structure the curriculum is to aim to meet as many of these goals through the use of our selected technology. We want to tie it closely to the above mentioned goals of treatment, to maximise functioning and move the client towards independence.

Over-Reliance on Technology

We set out to understand the concept of over-reliance by looking at the role technology plays in helping healthcare workers prescribe the correct medications in the correct doses, warning them of allergies, drug interactions and other possible adverse drug reactions.[26] Research has shown that technology can paradoxically have the opposite effect from the original intention make the system safer and more reliable. Unfortunately, some people develop an overreliance on the system and choose to think less, allowing the system to do the thinking for them. A system that was meant to *support decisions* became often misused as a system to *make* dosing decisions.

Thus, we want to avoid similar pitfalls in this project. Over-reliance could occur in our project if PWAs are taught to rely completely on the MCPA for cooking, making them unable or unwilling to cook without such equipment. We aim to encourage them to learn as many cooking skills as they can during the cooking lessons, but provide the MCPA as a way to supplement the skills they are unable to perform.

[25] https://pediatrics.aappublications.org/content/130/Supplement_2/S169
[26] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6534180/

As pointed out to us by our partners at SAAC, an example is how our target group finds it hard to do measurements such as weighing 100g of flour. It is unlikely that the MPCA would help them to perform this better as it merely provides a digital scale. Thus, we will first measure ingredients manually using a weighing scale before adding it to the MPCA. The level of assistance will then be recorded. We hope that the MPCA would give them the confidence to attempt this measurement step as they would have more time during the cooking class to do so. Previously, the teachers would have to measure everything for the students before class.

5. Review Methodology

Construction of Methodology

The evaluation methodology is highly inspired by developmental evaluation where the goal is to develop the idea of how to empower PWAs to cook.[27]

Data Sources

Data was collected through 4 different types of forms as well as monthly review sessions with the coaches.

Assessment Forms

The assessment form (*Appendix B*) serves two main functions:
(1) Monitoring of the cooking process from the perspective of coach & client
(2) Discovery function to understand the challenges and issues faced on the ground.

The were 3 category of forms, and 5 forms in total:

** Due to Covid-19, there were no volunteers during the pilot, and the perception form was not used.*

Category	Form name
1. Client-specific Forms *(Appendix B1)* Frequency: every session	a. Task Analysis
	b. Suitability of Chosen Technology
2. General Forms *(Appendix B2)* Frequency: Every recipe (every 3 session)	a. Recipe Complexity Form
	b. Experience Survey
3. Volunteer Form *(Appendix B3)*	a. Perception Survey

[27] https://www.cense.ca/developmental-evaluation-a-short-introduction/

1. Client-specific Forms

a. Task Analysis

This form sought to measure a client's ability to accomplish each step within the Thermomix recipe. Coaches were asked to record down the help provided for each step - e.g. physical, gestural, verbal, etc. This method of evaluation by help required is a common practice for PWAs and as such was adopted.

b. Suitability of Chosen Technology

This form was created to evaluate the suitability of using and teaching using the chosen MPCA (Thermomix) by measuring both client's and coach's perception towards it.

2. General Forms

a. Recipe Complexity Form

This form was used to gauge the complexity of a given recipe. This was done by considering 5 main factors[28]: (1) Number of ingredients, (2) Number of preparation steps, (3) Complexity of ingredient processing, (4) Complexity of preparation step (e.g. slice, add, mix), and (5) Duration of preparation.

Based on these 5 factors, coaches were asked to rate each factor on a 10 point likert scale (Very easy/little to Very difficult). The reference for rating was based on their prior cooking lessons with their classes to cook prata (rated 3 out of 10 on all factors).

b. Experience Survey

This is a 14 item, 4 point likert scale aimed to understand the coaches' and clients' overall experience of using the MPCA. This form was created based on the 'Knowledge, Attitude, and Behaviour model', to understand if the MPCA will continue to be used.

3. Volunteer Form

1. Perception Survey

With regards to the goal of fostering familiarity of the public towards the autistic community, we set out to launch a volunteer engagement plan together with our partner. This was put on

[28] http://ceur-ws.org/Vol-2028/paper26.pdf

hold due to the disruption from the pandemic. However, time was spent developing a survey according to the Theory of Planned Behaviour. This survey *(Appendix B2)* sets out to measure the changes in perception of an individual before and after being engaged with the autistic community for a period of time.

This form was adapted from the Societal Attitudes Towards Autism scale[29] with the advice of a public health expert. The target of the survey is to measure societal perception of PWAs as an indicator of level of social integration.

Monthly Review Sessions

Every month, a review session would be done to discuss the happenings of the sessions they have conducted. The review mainly serves an exploratory function to better understand the data they submitted, and seek to understand what happens on the ground. This includes trying to understand the challenges faced by coaches and brainstorming ways to support operations.

[29] https://www.researchgate.net/publication/230532527_Piecing_together_the_puzzle_Development_of_the_Societal_Attitudes_towards_Autism_SATA_scale

6. Observations & Discussion

Participants

For this pilot phase we engaged 2 classes within SAAC. From each class, 2 clients were chosen by SAAC to participate in the pilot. These clients would learn how to cook using the Thermomix during their weekly sessions. In total, the four clients were scheduled to attend a total of 12 classes, where they would learn to cook 3 different dishes (chosen by their coaches). The attendance rate of the four clients respectively were: 100%, 100%, 89%, 67%. Clients without full attendance were unable to attend school as they were physically unwell, hence they could not partake in the cooking classes.

This section consolidates the observations by the coaches and discusses the limitation of the pilot, as well as the possible improvements ahead.

Recipes Tested

In total, 6 dishes across 2 classes were attempted from scratch:

- Frozen fruit sorbet
- Chicken rice chilli
- Chocolate chip cookie
- Fruit ice cream
- Creamy mushroom soup
- Strawberry jam

Key Observations

These were the key observations by the coaches through the pilot phase.

1. **Chosen MPCA (Thermomix) is a suitable assistive machinery for PWAs**

   Throughout the majority of the cooking process, the technology engaged as an assistive instrument did not pose obvious hindrances to the cooking class. Clients were generally able to perform the cooking instructions, together with basic understanding of the safety of instruments. Other MPCAs with similar technology parameters as the Thermomix would thus be compatible as well.

The area with the most level of assistance needed would involve setting up the equipment and cleaning up. In the parameters of this project, the coaches took on the role of the above areas as clients were not exposed to the equipment before.

2. **Clients have the chance to undertake recipes and lessons they previously cannot**

   One of the most significant changes was the way the cooking lessons were now conducted. In the past, clients would only be able to attempt very basic recipes. These would include foods in or similar to the ready-made category such as prata and premixes for confectionery goods.

   With technology, we were able to unlock higher levels of creativity and different opportunities for them, trying out novel and more adventurous recipes. As a result, the coaches were also informally able to discover the potential of certain clients and their skills previously unknown.

3. **Increased interest and engagement with clients**

   Clients were observed to be less distracted during the lessons, and more engaged. One observation was how the engagement levels were also closely tied to the preferences to the recipes undertaken. However, their enjoyment of the recipes did not influence their willingness to cook and participate in the classes.

   Informally, it was also noted that other clients not involved in cooking with the Thermomix (i.e. clients who resumed normal cooking classes) would have their interest piqued and often expressed curiosity and interest in what their peers were doing.

4. **Greater ease & creativity in teaching for coaches**

   The operation of the MPCA was noted by the coaches to be easy to use. There was also been a general increase in ease of conducting the lessons (lesser teaching aids required) with the help of the machine.

   The coaches have also expressed an increased enjoyment after integrating the equipment within their classes. One reason could be the enhanced creativity involved in deciding lesson structures, as well as the curation of the lessons based on the preferences and feedback of the clients.

Limitations

1. **Covid-19 restrictions - limitation to monitoring & volunteering**

   It was initially planned for us to go on site routinely to check the working condition of the Thermomix, and to observe the lessons first hand. However, due to Covid-19 restrictions, this was not possible.

   Additionally, due to the restrictions, no volunteers could go down on-site to assist with the project and interact with the clients.

2. **Technology-aided lessons take more time**

   Classes with MPCAs employed took significantly more time compared to regular classes and were more likely to overrun.

   Coaches also highlighted that some clients, given sufficiently long time, would be able to do the tasks more independently. However, due to time constraints, coaches had to offer more assistance to them.

   One coach has suggested that they alternate their clients' MPCA lessons - such that they only teach 1 client a week instead of the initial 2. This has since been implemented post-pilot, and has made the pace of classes more manageable.

3. **Seeming skill regression when recipe is changed**

   In the assessment forms, it appeared that some clients would regress in their skill acquisition after a recipe is changed. According to the coaches, a slight regression is expected whenever there is change, but over long periods of time, transferable general skills will be retained.

4. **No statistical conclusion can be made**

   Due to the small sample size, and the exploratory nature of this pilot, we chose not to conduct any statistical analysis. However, we plan to continue tracking each clients' skill acquisition to better understand the learning process.

5. **Cognitive limitations remain**

   Though the MPCA greatly helps in the processing of food, it still requires different levels of cognition from the client. The clients needed to possess (1) attention - look at the

screen; (2) semantic processing – understand the meaning behind the numbers; and (3) psychomotor skills – correctly turn the knob to the right number.

One observation, in particular, was that clients could not accurately turn the knob because they were not able to understand numbers. Future work will be done to include a skill-based assessment of transferable skills for MPCAs, as well as alternative workflows to accomplish the same task (measuring ingredient) using simpler cognitive processes.

6. **Sense of danger**

Our chosen MPCA is a very safe cooking aid. However, it still poses certain dangers, for example: (1) the blades inside the pot are sharp, and (2) hot steam is produced from cooking. As such, coaches would wash the equipment themselves. However, the coaches also noted that for clients who had a lower sense of awareness, more assistance for them will be needed.

Future Improvement/Considerations

1. **Post-pilot assessment forms (*Appendix C*)**

Reviewing the observations and limitations of the pilot, a new assessment form was created to aid continual data collection. This assessment form sought to (1) understand operational burden, (2) track skill-based learning, and (3) serve an exploratory function. This survey will be hosted on Google forms, making it easy for coaches to assess their past entries.

Understanding of the operational burden requires assessing the (a) perceived difficulty of class by client and coach, (b) time taken for class, and (c) complexity of dish.

Tracking of skill-based learning is determined through the level of aid required for different MPCA-based skills that are deemed as transferable (e.g. pouring ingredient in, turning knob correctly) as well as other skills learnt (e.g. cracking egg).
Additionally, the assessment serves an exploratory function whereby it includes open-ended questions aimed at understanding qualitatively (a) the difficulties faced, (b) new things that were tried, and (c) other observations.

2. **Innovating ways to measure food**

   One way to tackle the challenge of cognitive limitation is to reframe the tasks. For example, a client may not be able to measure 500g of flour using the MPCA. The clients may not be able to understand 500g because (a) 500 is a big number, and (b) grams is an arbitrary concept. Instead, this task can be reframed to scooping out 4 cups of flour.

3. **Exposure and warning before commencement**

   In future iterations, it would be important to induct clients to the chosen MPCA and the sounds and smells associated with it. This will help prevent any initial shock or aversion.

4. **Limited efficacy of large number of volunteers**

   In discussing with coaches, they highlighted the fact that large numbers of volunteers helping may hinder them more than they help. This is because (1) clients need time to warm up to volunteers, (2) coaches need to teach volunteers, and (3) volunteers might unintentionally distract clients from their tasks. Coaches estimated that volunteers needed to come down 10-20 times before being able to effectively help the coaches.

   We are rethinking our volunteer model and how to promote social integration between clients and society without increasing the burden on ground workers.

7. Next Steps

Proof Of Concept

This paper, along with all the resources created in the conducting of this pilot project, will continue to be made available to all who are interested in implementing similar methodologies. Resources will include surveys, curriculum structures as well as assessment forms for the conducting of similar lessons for PWAs as attached in the appendices.

Partnership

The original plan was to conclude the project with SAAC (DAC), after the pilot trial of 6 months. However, we are exploring the potential of an extended arrangement with our partner, after observing positive changes to various areas in their ways of working. This includes an increase in self-efficacy of the coaches, higher engagement of clients and even increasing culture of innovation within the team. As part of Solve n+1's commitment, we will also donate the equipment purchased for the purposes of Feed 52 to SAAC for the continuation of the work.

Potential Collaborations

We will be invested into exploring collaboration opportunities with different organisations or institutions to further our hypothesis of facilitating social integration. We want to discover how bodies such as SPED institutions or employment organisations can engage the surrounding communities more intentionally or even possibly innovate their own services. This can happen in a few ways, either through the implementation of this paper in their organisation, or reaching out to Solve n+1 for further co-creation and execution.

Acknowledgements

We are deeply grateful for the help from our volunteers, stakeholders and partner, St Andrew's Autism Centre (DAC - Sengkang), that made this project possible. This commitment has inspired us to continue to stay open to ways to live out the vision of a 'new society' where the community and PWAs find themselves even less divided.

Appendix A

Safety

These multi-purpose cooking appliances are considered safer cooking aids due to the many safety mechanisms. This is in sharp contrast to many kitchen tools which may introduce new hazards.

As an example, one feature is the auto-locking feature seen in many brands such as Thermocook.[30] This prevents the mixing bowl from being pulled out when there is a cooking process going on. This prevents users from accidentally pulling out a bowl which is being blended.

Another feature is that all cooking processes happen inside the mixing bowl via electronic controls on the control panel. The user is not required to light fires to heat up the bowl or to transfer the food to a blender. The food can even be stirred automatically while it is being heated while the lid is on. As long as the multi-purpose cooking appliance is not over-filled, splashes or spillage are unlikely to occur. Furthermore, if we follow the easy recipes provided, there will not be any over-filling since all the ingredient amounts have been worked out by the companies beforehand to ensure recipe success.

The user definitely has to take some precautions when using these multi-purpose cooking appliances, but since they provide a contained cooking environment for the food products, many of the dangers of traditional cooking can be avoided when using them.

[30] http://optimumappliances.com/assets/manual_pdf/EN/ATH_ThermoCook_Manual_Latest_01.pdf

Appendix B1

Client-Specific Forms

How to Use These Forms:

- We will be testing 3 recipes, 3 times each. We will test them in the sequence AAABBBCCC.
- For each test, please fill in the '*Task Analysis*' form for that recipe & '*Suitability of Thermomix*' form
- At the end of each recipe cycle (every 3 weeks), please fill in the '*Experience Survey*'
- '*Recipe Complexity'* form will be in a separate document
    - E.g. 2 June start recipe 1-> fill in sometime around 19-22 June after finishing all the lessons for recipe 1

Timeline:

- 2 June – 18 June: Recipe 1; both clients will attempt the recipe during 1 class, taking turns to use the Thermomix, total 3 attempts over 3 weeks per client
- 23 June – 9 July: Recipe 2
- 14 July – 30 July: Recipe 3
- Check-ins on progress on Coach E Week 2 (28 June - 4 July), Week 6 (26 July – 1 Aug) and after Coach E finishes (23-29 Aug)

Attendance:

(Record if client unable to turn up, if not please leave as blank)

- One client (do not record name, PDPA) from [which class e.g. Wednesday class] absent for [date]

1. Task Analysis for Recipe 1: Frozen Fruit Sorbet

Key: Unable to do (0), P= Physical (1), PP= Partial Physical (2), V= Verbal (3), G= Gestural (4), I= Independent (5)

Client	A	**1st Trial**	**2nd Trial**	**3rd Trial**
Coach	J			
Date		**02/06**	**16/06**	**30/6**
Please add remarks into appropriate step	Step 1: Measure 60-100g of sugar (up to coach)	PP	PP	PP
	Step 2: Measure 500g mixed frozen fruits	PP	PP	PP
	Step 3: Measure lemon juice and egg white (if using)	V	P	P
	Step 4: Place sugar in mixing bowl	V	I	I
	Step 5: Set grind 10 sec/speed 10.	P	PP	PP
	Step 6: Add frozen fruit, lemon juice (if using) and egg white (if using)	V	I	I
	Step 7: Blend 1 min 30 sec/speed 5. Serve immediately	P	PP	V
Remarks		02/06: Client needed help with measurements as he was not familiar with using the electronic scale, and was able to pour ingredients in with instructions. Required physical help to stop client from fiddling with		

		the knobs as he would constantly turn it (causing the machine to either mix too fast or stop) 16/06: Client showed improvement with using the Thermomix since he is more familiar with the machine now. Still requires PP to operate the machine as he tends to crank up the dial and press 'next' multiple times even without completing the step. 30/06:Client was independent with inserting the spatula into the mixer and mixing while the machine was blending, however needed some verbal prompts to ensure he continue mixing for the whole 1 min 30 seconds.

2. Suitability of Chosen Technology

Key: Unable to do (0), P= Physical (1), PP= Partial Physical (2), V= Verbal (3), G= Gestural (4), I= Independent (5)										
Client	Mr A	**1st Trial**	**2nd Trial**	**3rd Trial**	**4th Trial**	**5th Trial**	**6th Trial**	**7th Trial**	**8th Trial**	**9th Trial**
Coach	J									
Date		2/06	16/06	30/6	7/07	14/07	21/07	28/07	04/08	11/08
1	Able to take out the thermomix and connect it to power	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	Able to turn on the thermomix	NA	NA	NA	NA	NA	P	P	P	P
3	Able to navigate to the appropriate recipe	NA	NA	NA	NA	NA	NA	P	P	P
4	Able to start the cooking process	P	V	V	V	V	V	P	P	V
5	Able to add ingredients according to on screen instructions	P	V	V	P	V	V	V	V	I
6	Able to operate thermomix according to guidance given in the recipe (press next, turn the knob to change speed of mixing)	P	P	V	P	P	P	V	V	I
7	Able to pour ingredients out into appropriate container	NA	NA	NA	NA	NA	NA	V	V	I
8	Able to carry out steps in recipe that require equipment outside of the thermomix	NA	NA	NA	NA	NA	NA	V	V	I
9	Able to demonstrate basic understanding of safety with the thermomix (0-5 can be used here instead as 0 - not at all to 5 - perfect)	3	3	3	3	3	3	4	4	4
10	Able to clean the thermomix and other cooking equipment safely	NA	NA	NA	NA	NA	NA	NA	NA	NA

Remarks		Coaches usually do the set up and cleaning of thermomix for clients as thermomix may be too heavy and clients might drop it. Coaches are trying to minimize the chances of clients touching the blade in the mixer hence clients do not do cleaning at the moment. From 28/07, clients have slowly been introduced to more steps with operating the machine such as turning on the thermomix and cleaning it.

Appendix B2

General Forms

Recipe Complexity Form

This form is meant to evaluate the complexity of recipes used for the lessons assuming there is no MPCA to aid in the steps. This is to demonstrate that PWAs can attempt recipes that are more complex with the aid of a MPCA.

Recipe Complexity Form

Key: 1-10, 3 is an average PWA's cooking class recipe difficulty

		Recipe 1: Frozen fruit sorbet	**Recipe 2: Chicken Rice Chili**	**Recipe 3: Chocolate Chip Cookie**	***Benchmark: Instant mix pancake**
Date		**02/06**	**07/07**	**28/07**	**NA**
1	Number of ingredients	4	4	5	3
2	Number of steps	5	3	5	3
3	How challenging was the ingredient processing overall assuming no thermomix	7	7	6	3

4	How challenging was the preparation steps that would be required to make the product overall assuming no thermomix	4	7	6	3
5	How long was this product supposed to take to make	7	6	5	3
Remarks		Recipe 1: The ingredients and steps were fairly simple but the thermomix helped to reduce the amount of stirring and mixing that would have been intense to churn out sorbet-consistency desserts. Recipe 2: Chilli sauce would have required a lot of grinding and pounding should there be no thermomix. The time taken for them to grind the chilli, ginger, and onion into paste would have taken very long as well. Recipe 3: There were many ingredients to measure out in preparation for the cookie dough which was similar to doing it without a thermomix. However, as the thermomix was timed, it reduced the need for coaches to tell clients when to stop mixing the dough (clients did not have to judge if dough will not be under mixed, over mixed).			

Experience survey

Key: Likert scale, 1-4, Strongly Disagree (1), Strongly Agree (4)					
Class	e.g. Wednesday's class	**1st cycle**	**2nd cycle**	**3rd cycle**	**Remarks**
Coach					
Date		**30/06**	**21/07**	**11/08**	
1	The clients were able to make the food item more easily following the introduction of the MPCA machine	4	4	4	

2	The clients were less distracted during the lesson	3	3	4	Clients were only required to pour in the ingredients and turn a knob for the machine to mix on its own
3	The clients were affected negatively by the Thermomix method of cooking (sensory overload from garlic smell, sound, etc)	1	2	1	The chilli was quite spicy when breathed in/ touched
4	I feel that clients are able to perform cooking tasks more effectively like chopping garlic with the aid of a Thermomix	3	3	2	1st cycle didn't require much prep work for ingredients 3rd cycle didn't require any chopping/ prep work out of the Thermomix
5	I feel like clients are more open to learning new skills as a result of learning cooking with the aid of a Thermomix	3	3	3	
6	I feel like clients are more well versed with basic cooking skills (non-Thermomix) as a resultof learning cooking with the aid of a Thermomix	2	2	2	Sessions were not enough to tell how much basic cooking skills they acquired out of it
7	I feel that the presence of the Thermomix has helped the client to discover new skills he is good at, which were previously unknown	2	2	3	Skills such as ingredients naming and reading instructions/ numbers

8	The clients enjoy having a Thermomix machine to support their cooking skills	4	3	4	Client's enjoyment depends on the food product they would be making
9	I know how to use the Thermomix machine (referring to coach)	4	4	4	
10	I know how to effectively teach clients how to cook dishes and use the Thermomix to supplement cooking skills when the clients face difficulty with a skill (such as chopping garlic)	4	4	4	
11	Teaching the lesson was harder with the help of the Thermomix machines	1	1	1	
12	I feel that more teaching aids (apart from Thermomix) are required for the lesson	1	2	1	
13	I enjoy integrating the Thermomix into my cooking lessons	4	4	4	
14	I do not want to keep using the Thermomix for my lessons	1	1	1	

Appendix B3

Volunteer Forms

Perception Survey

This was created based on the Theory of Planned Behaviour. Thus, we are investigating the attitude, subjective norms, perceived behavioral control and their impact on the intention to befriend PWAs in the long term. Some questions are adopted from SATA where appropriate.

For each of the questions below, circle the response that best characterises how you feel about the statement, where 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree

Age:

Gender: Male / Female

Ethnic group: Chinese / Malay / Indian / Others (please specify):_____

Have you had any personal contact with people with autism? Yes / No

If Yes, please describe your relationship to them:_____

Attitude towards PWAs

(remove header in volunteer version)

1. I would be comfortable being around a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

2. I would be comfortable interacting with a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

3. I would be comfortable working together with a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

4. People with autism should be fully integrated into the workforce.

1	2	3	4
Strongly Disagree			Strongly Agree

5. People with autism should be fully integrated into the community.

1	2	3	4
Strongly Disagree			Strongly Agree

6. I am interested in befriending people with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

Subjective norms towards PWAs

(remove header in volunteer version)

7. People around me would be comfortable being around a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

8. People around me would be comfortable interacting with a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

9. People around me would be comfortable working together with a person with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

10. People around me feel that people with autism should be fully integrated into the workforce.

1	2	3	4
Strongly Disagree			Strongly Agree

11. People around me feel that people with autism should be fully integrated into the community.

1	2	3	4
Strongly Disagree			Strongly Agree

12. People around me are interested in befriending people with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

Perceived behavioural control of participants in interacting with PWAs

(remove header in volunteer version)

13. I am able to work together with people with autism to cook a dish

1	2	3	4
Strongly Disagree			Strongly Agree

14. I am able to make friends with people with autism

1	2	3	4
Strongly Disagree			Strongly Agree

15. I am able to engage in conversation with people with autism.

1	2	3	4
Strongly Disagree			Strongly Agree

16. I am able to understand the feelings of people with autism

1	2	3	4
Strongly Disagree			Strongly Agree

Intention to befriend PWAs in long term

(remove header in volunteer version)

17. I am likely to remember the people with autism I have been introduced to.

1	2	3	4
Strongly Disagree			Strongly Agree

18. I am likely to greet the people with autism I have been introduced to if I encounter them in the community.

1	2	3	4
Strongly Disagree			Strongly Agree

19. I would be willing to help the people with autism I have been introduced to if I see them encountering difficulties in the neighbourhood.

1	2	3	4
Strongly Disagree			Strongly Agree

20. I am likely to continue finding opportunities to meet up and maintain my friendship with the people with autism I have been introduced to during this project.

1	2	3	4
Strongly Disagree			Strongly Agree

21. I will organise gatherings to introduce my friends to people with autism I have been introduced to.

1	2	3	4
Strongly Disagree			Strongly Agree

n+1

Appendix C

Revised Assessment Form

1. Coach name (multiple choice)
2. Date of session
3. Name of client (multiple choice)
4. How long was today's class?
    a. Client was absent
    b. 15 minutes
    c. 30 minutes
    d. 45 minutes
    e. 1 hour
    f. More than 1 hour
5. What recipe you are cooking today
6. PWA Thermomix skill assessment

    (Aid: Unable to do it, Not applicable, Physical, Partial physical, Verbal, Gesture, Independent)
    a. Pouring ingredients into Thermommix
    b. Scraping of inside of Thermomix
    c. Accurately turning of knob
    d. Measuring ingredients (using cups)
    e. Measuring ingredients (Using Thermomix)
7. Were there any other skills applied? What level of aid was offered? (open-ended)

    (e.g. cracking egg - independent)
8. How did the client find today's class? (likert 5 point - Very easy to Very Difficult)
9. How would you rate the difficulty of today's class? (likert 5 point - Very easy to Very Difficult)
10. Were there any difficulties faced today?
11. Is there anything new you tried today?
12. What else did you observe from today's class?
13. Is there anything else you would like to add?

    (e.g. Plan to alternate cooking classes for clients - 1 week 1 client)