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# Examining Model Similarity for Exercise Self-Efficacy among Adults Recovering from a Stroke: A Community-Based Exercise Program

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**Abstract:** We used a single-case experimental research design to examine the effect of modelling (peer versus non-peer) on exercise self-efficacy in stroke survivors who participated in a community-based exercise program. Data were obtained using an ABCA design: ($A_1$) no model/baseline 1 (3 weeks); (B) peer model (6 weeks); (C) non-peer model (6 weeks); and ($A_2$) no model/baseline 2 (3 weeks). Four participants completed self-efficacy questionnaires after each weekly session. Overall, participants reported higher exercise self-efficacy in the model conditions (Cohen's $d$ range from −0.37 to 4.22), with ratings appearing highest for the non-peer model. Modelling in general may help stroke survivors increase their exercise self-efficacy. Lastly, we provide our reflections on the pragmatics of completing a study within a community setting.

**Keywords:** modelling; peers; single-case design; self-efficacy; stroke



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## 1. Introduction

In Canada, approximately 2% of the population are stroke survivors [1] and 88% of people recovering from a stroke have long-lasting motor deficits [2]. To help individuals prevent, recover from, and maintain health after a stroke, physical activity and exercise have been recommended [3,4]. However, a large majority of people recovering from stroke are not physically active [5]. To help understand how people with physical disabilities can become more active, a meta-review encouraged researchers to move beyond describing barriers/facilitators to physical activity participation and instead focus on testing theory-informed interventions that span both intra- and interpersonal dimensions [6]. One example of theory-informed physical activity interventions that have been found to be efficacious within the context of stroke survivors are those based on self-efficacy [7].

Self-efficacy represents one's belief in their ability to achieve certain tasks [8]. Moreover, exercise self-efficacy is one's belief in their ability to successfully perform exercise [9]. People recovering from a stroke live with functional impairments that make it more difficult to be physically active, consequently reducing their exercise self-efficacy [5,7]. According to Bandura [8], there are four sources of self-efficacy: (A) past experience, which is based on previously achieved personal mastery of tasks, (B) vicarious experiences (modelling), which involves observing others' successful completion of a task, (C) verbal persuasion, which is the verbal and non-verbal feedback related to the performance of a task, and lastly (D) affective/physiological responses, which include the emotional/physical responses affecting the perceptions of personal competency. Followed by past experiences, modelling is the second most effective way to increase an individual's self-efficacy [10]. Among older adults, a systematic review examining the effect of 23 behaviour change techniques (BCTs; active ingredients of a behaviour change intervention [11]) showed that modelling physical activity had medium effects on self-efficacy and physical activity behaviour (Cohen's $d = 0.41$) [12]. More research is needed to better understand how the sources of self-efficacy, specifically modelling, operate on exercise self-efficacy post-stroke [13]. In addition, the combination of BCTs in physical activity interventions limits the ability to discern their effects individually. Thus, there is a call for research to experimentally examine BCTs individually [14]. As such, our study aims to fill these gaps.

Modelling has been found to be most effective when performed by someone with similar characteristics, such as peers (e.g., [15]). Peer-led programs have shown potential in promoting healthy behaviours among stroke survivors, but further research is needed to confirm their effectiveness [16]. A study on a peer-led wheelchair training program (including modelling) for manual wheelchair users demonstrated significant improvements in self-efficacy [17]. However, the peer-led wheelchair training program included practical skills training and the control group was not subjected to a non-peer-led program. Thus, more research is required to determine if the peer-led component is solely responsible for the positive outcomes. As such, contrasting the effects of peer vs. non-peer models on exercise self-efficacy is necessary, particularly among disability groups.

To assess exercise self-efficacy accurately, distinguishing motivation from capability is essential [18]. Including expected motivation in assessments results in self-efficacy-as-motivation, reflecting both a person's ability (capability) and willingness (motivation) to engage in a task. To comply with Bandura's [8] original conceptualisation of self-efficacy-as-capability, Williams and Rhodes [18] recommended modifying questionnaire stems to include the phrase "if you wanted to" as a way to parse out motivation from capability. They also recommended including both assessments in a study. Accordingly, we applied both recommendations to enhance our theoretical and practical understanding of modelling on exercise self-efficacy while testing types of models within a community-based exercise program for stroke survivors.

Overall, there is a lack of understanding on how a community-based exercise program that incorporates peer models influences self-efficacy in stroke survivors. Thus, the purpose of this study was to compare changes in exercise self-efficacy levels among stroke survivors participating in an 18-week community-based exercise program who were exposed to three conditions in the following order: ($A_1$) no model (3 weeks); (B) peer model (6 weeks); (C) non-peer model (6 weeks); and ($A_2$) no model again (3 weeks). In accordance with self-efficacy theory, we anticipated that these adults would have greater exercise self-efficacy (both as-capability and as-motivation) when a peer model was integrated within the program (B) than when there was no model ($A_1$, $A_2$), and (C) a non-peer model. We also hypothesised that participants would report higher exercise self-efficacy levels with the non-peer model (C) than with no model ($A_1$, $A_2$) at Baseline 2.

## 2. Materials and Methods

### *2.1. Research Design & Paradigm*

This study was co-constructed with researchers from McGill University (Montreal, QC, Canada), Queen's University (Kingston, ON, Canada), and Viomax, an established community partner (Montreal, QC, Canada). As this study was conducted within a community-based setting with Viomax, we used their existing exercise program to test our hypothesis. This study was also part of an unpublished master's thesis from one of the co-authors at McGill University [19] and later modified and prepared for publication. We selected the beginner/intermediate stroke group exercise course because most participants would be relatively new to exercise. We employed a single-case experimental design; specifically, a concurrent multiple baseline design with an ABCA format [20]. The ABCA format of the multiple baseline design consisted of a ($A_1$) no model/Baseline 1 (3 weeks); (B) peer model (6 weeks); (C) non-peer model (6 weeks); and ($A_2$) no model/Baseline 2 (3 weeks).

The duration of each phase was decided based upon the length of the existing community program (9 weeks).

### 2.2. Participants

Due to this study being conducted in the community setting and our pragmatic viewpoint, we included all participants enrolled in the program, regardless of their past exercise experience. Eligible participants were 18+ years of age, stroke survivors, medically cleared to participate in exercise, French/English speaking, and were participating in the Viomax group exercise course for stroke survivors. Participants were excluded if they had a cognitive impairment diagnosed by a medical professional. A total of seven participants were part of the study and provided informed consent; two participants withdrew midway without reasoning and one participant dropped out of the study because they missed too many classes due to an illness/injury (not related to the study exercises). Thus, a total of four participants were exposed to all conditions, which is above the minimum of three participants for level II evidence in single-case designs [20].

### 2.3. Procedures

The Viomax beginner/intermediate post-stroke group exercise program took place for an hour once a week in a gymnasium and was led by a kinesiologist. The exercise training protocol was part of the existing program and was designed by Viomax; therefore, the only modification from the research team was the addition of the model. Participants took part in a total of 18 exercise sessions throughout the program. The kinesiologist and model were present for all sessions, with the model demonstrating exercises when needed. For each 60 min session, the first 30 min included warm-up activities (e.g., performing limb rotations). After a 5 min break midway through class, participants were taught new exercises that differed each week, which were demonstrated by the model. For the latter 25 min of the class, the participants conducted the exercises on their own using the equipment set up in the gym (e.g., stationary bicycle, treadmill, resistance bands). See Figure 1 for a flow of the exercise sessions.

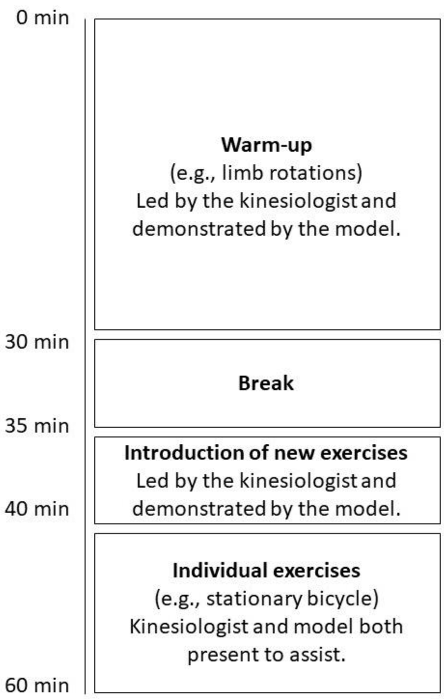


**Figure 1.** Layout of each exercise session.

Prior to the start of the program, a member of the research team explained the study and invited interested participants to sign the consent form. During the first three sessions

(Baseline 1, Condition $A_1$), participants engaged in the course normally without a model, aside from completing the baseline questionnaire after each class. In the fourth session, a peer model was added to the class for the next six sessions (Condition B). The invited peer model was from the advanced group exercise class at Viomax and therefore had experience with the exercises and procedures. The peer model did not receive any additional training for this study. The role of the peer model was to assist the kinesiologist and demonstrate the exercises to the participants (e.g., demonstrating a bicep curl). Participants were informed that the peer model was a participant from a more advanced class who volunteered to help demonstrate the exercises until the December break (end of Condition B). The participants were able to interact with the peer model during the sessions to ask them questions about the exercises; however, they were not aware of the purpose of having the peer in the study.

The December break (3 weeks) served as a washout period as the group exercise classes were not being held and the participants were not exposed to a modelling condition. Once the group exercise classes resumed in January, the participants were informed the peer model was no longer able to attend classes but was replaced by a university student from our research team. This student acted as the non-peer model for 6 weeks and had the same role as the peer model in demonstrating the exercises (Condition C). The university student was matched on the self-disclosed gender of the peer model and did not have a disability. Participants were solely told that the goal of this study was to determine whether the classes could improve their exercise self-efficacy. Following the non-peer model condition, a washout period of 2 weeks was implemented as participants were not exposed to any modelling condition. After the washout, we collected data for three weeks representing Baseline 2 (Condition $A_2$). Upon completion of data collection, the participants received a short debriefing session to explain the true objective of the study. Participants were compensated $60 for completing the study. Ethical approval was obtained from the Center for Interdisciplinary Research and Rehabilitation prior to starting the study (CRIR-1341-0518).

The Peer and Non-Peer Models. The group exercise classes were led by the same Viomax kinesiologist across all conditions of the study. The models were allowed to participate in the activities of the class and interact with the participants. They were instructed to talk about their previous experiences with exercise informally, but to avoid giving feedback on participants' exercise performance to control for other sources of self-efficacy (i.e., verbal persuasion). The main task of both models was to demonstrate the activities presented by the kinesiologist. Once the activity was modelled, the models also completed the activity prescribed by the kinesiologist. Therefore, the difference between the model conditions was the person who acted as the model. In the peer model condition, the peer model was a white male in his sixties who had a stroke and still lived with post-stroke complications (less balance and strength on one side of the body) although his condition was much less severe than the study participants. He had previously and was still taking part in the advanced post-stroke classes. In the non-peer model condition, the model was a white male Physical and Health Education student in his early twenties who had not previously experienced a stroke.

### *2.4. Measures*

At Baseline 1, participants completed a questionnaire for demographic information, physical activity, and self-efficacy. Within Conditions B and C, participants answered a brief task-specific exercise self-efficacy questionnaire (i.e., self-efficacy-as-capability) and a barrier self-efficacy questionnaire (i.e., self-efficacy-as-motivation) after each class.

**Demographic Questionnaire.** A demographic questionnaire was given to participants to collect general information (e.g., age, sex, time since the stroke, education).

**Leisure Time Physical Activity Questionnaire.** Participants completed the Leisure Time Physical Activity Questionnaire for People with Spinal Cord Injury (LTPAQ-SCI) [21]. This questionnaire assesses participants' self-reported frequency and duration (in minutes) of mild-, moderate-, and vigorous-intensity leisure-time physical activity during the last seven days. The frequency and minutes of mild, moderate, and vigorous physical activity were multiplied to create a total physical activity score, in minutes. The LTPAQ-SCI was validated against an hour-to-hour recall of all daily activities. Although this questionnaire was validated in a sample of adults with SCI, it has been used with other disability groups [22] and the wording applies to a stroke population.

**Self-Efficacy.** Participants responded to two self-efficacy measures after each class. As per Bandura's recommendations to assess self-efficacy, participants rated their self-efficacy on a 0% to 100% scale [23]. First, self-efficacy-as-capability was measured with a task self-efficacy scale to assess the participants' confidence to do the exercises in the class. Using a graded self-efficacy scale, participants indicated their confidence to do the exercises in the class as shown by the model. They provided their confidence rating on a graded list starting at their confidence to complete 'a quarter' of the exercises to 'all' the exercises (4 items). Importantly, the phrase "if you wanted to" was added to the stem to remove the motivational aspect of self-efficacy and capture self-efficacy-as-capability [18]. This questionnaire was pilot tested and modified until participants indicated they understood how to complete the questionnaire. Self-efficacy-as-motivation was assessed with a barrier self-efficacy scale, where participants rated their confidence in exercising when presented with five different barriers: "when physically fatigued", "when exercise is boring", "with minor injuries", "in spite of other time demands", "in spite of family responsibilities" [24,25]. The sixth barrier, "in spite of your work schedule", was removed as most of the participants were retired. A mean of the four items was calculated for each participant. These questionnaires have been found to be valid and reliable across various populations [18,24,25].

### *2.5. Data Analysis*

Graphic analyses were conducted on the data using Excel (version 16) to compare the exercise self-efficacy levels within/between-conditions [26]. Graphs for each participant can be found in the Supplementary Materials. Means, standard deviations, and medians were then calculated for each condition. A within/between-condition visual analysis [27] of the graphs was conducted for both types of self-efficacy, separately. For the within-condition analyses, stability, level, and trend analyses were conducted. Two stability/variability metrics were calculated. First, a common rule of thumb for variability is at least three observations with no more than 10% variation [28]. Given our scale of 100%, we accepted a 10% variability in score for it to be determined stable. Second, the median was used to calculate a stability envelope, with stability being considered when 80% of the data are within the range that is 25% of the median [27]. Level was determined using three metrics. Following Lane and Gast's [27] recommendations, a relative level change and an absolute level change were calculated. For relative level change, the scores within a condition were split in half. The median scores of the second half were subtracted from the median scores from the first half to report whether there was any change within the condition. Note that the relative level change was not calculated for the Baseline 1/2 conditions because there were only three values. Absolute level change is the subtraction of the last value from the first value in each condition. The third metric was a mean level line which was added to the figures to illustrate the mean level of the condition. Lastly, a trend line was added to each figure by conducting an ordinary least-squares linear-regression and reporting the unstandardized coefficient (B) [28]. Trend lines were only calculated for the peer model and non-peer model conditions because there were more than three data points.

For the between-condition analyses, four metrics were used: relative level change, mean level change, effect immediacy, and overlap [27]. Relative level change examined the difference between the median value of the first half of one condition and the second half of another condition. To complement our visual analysis and as recommended by Lane and Gast [27], the mean level change between two conditions was reported through an effect size (Cohen's *d*). Small, medium, and large effects were represented by values of 0.30, 0.50, and 0.80, respectively. As small samples may be highly variable, we decided to use effect size calculations as an additional metric to add confidence to our visual analysis, and not to interpret them as a main finding. To show effect immediacy, the absolute level change examined the last value of one condition with the first value of the next condition. Finally, overlap represented the percentage of data from one phase that falls within the range of data of another phase [29]. Two metrics were used to assess overlap: percentage of non-overlapping data and percentage of overlapping data [27]. Regarding percentage of non-overlapping data, the highest value of one condition is identified, then the percentage of scores in the next condition that is above that value is calculated. For percentage of overlapping data, the highest score of one condition is used to calculate the percentage of scores from another condition that is the same or lower than that high score.

## 3. Results

Participant demographic information is presented in Table 1. The four participants in our study were individuals who returned to complete the beginner/intermediate course at least a second time. A visual analysis of self-efficacy levels of the participants throughout the weeks across all conditions was conducted.

**Table 1.** Demographic variables.

| | Age | Gender | Mobility | Years Living with Stroke | Baseline Leisure Time Physical Activity (min) |
|---|---|---|---|---|---|
| P1 | 69 | Female | Requires cane and personal assistance | 10 | 125 |
| P2 | 83 | Male | Requires wheelchair, cane, and personal assistance | 16 | 240 |
| P3 | 82 | Male | Requires wheelchair | 8 | 240 |
| P4 | 79 | Female | Requires rollator walker | 3 | 180 |

### *3.1. Self-Efficacy-as-Capability*

**Overall Within-Phase Analysis.** For detailed information regarding the variability/stability, level, and trend analyses for each participant, see Table 2. Overall, Participant 1's self-efficacy-as-capability was highly variable but did not change within the conditions (i.e., there were no visually meaningful changes as per level metrics and trend lines). Data were stable for Participant 2 with self-efficacy-as-capability appearing to improve in the non-peer condition. Participants 3 and 4 appeared to increase their self-efficacy-as-capability in both the peer model and non-peer conditions with Participant 3 having variable data in Baseline 1 and Participant 4 having variable data across conditions. In summary, three out of four participants reported an increase in self-efficacy-as-capability within the non-peer model condition while two of the four participants reported an increase within the peer model condition.

**Overall Between-Phase Analysis.** For detailed information regarding the relative and mean level change and overlap analyses, see Table 3. For Participant 1, self-efficacy-as-capability was higher at Baseline 1 than the peer model, but had 100% of peer model data overlapping with Baseline 1 values. Participant 2 had higher scores in the non-peer model condition compared to the peer model condition and Baseline 2 with little overlap with the peer model condition. For Participant 3, a large increase in self-efficacy-as-capability was reported between Baseline 1 and the peer model condition with only 17% overlapping data. This increase was retained through the non-peer model condition and even accentuated in Baseline 2. For Participant 4, self-efficacy-as-capability remained similar throughout all conditions. Overall, one participant reported changes in self-efficacy-as-capability for the peer model condition when compared with Baseline 1. Two of four participants reported higher self-efficacy-as-capability in the non-peer condition compared to the peer model condition.

**Table 2.** Within-phase analyses including variability/stability, level, and trend for self-efficacy-as-capability.

| Self-Efficacy-as-Capability | | | | |
|---|---|---|---|---|
| **Conditions** | **Participant** | **Variability/Stability** | **Level** | **Trend [5]** |
| Baseline 1 | P1 | Unstable [1]<br>Unstable (72.5 ± 18.13) [2] | +32.5 improving [3] | / |
| | P2 | Stable [1]<br>Stable (65 ± 16.25) [2] | −10 deteriorating [3] | |
| | P3 | Unstable [1]<br>Stable (50 ± 12.5) [2] | +10 improving [3] | |
| | P4 | Unstable [1]<br>Unstable (65 ± 16.25) [2] | −17.5 deteriorating [3] | |
| Peer Model Condition | P1 | Stable [1]<br>Stable (68.75 ± 17.19) [2] | −2.4 deteriorating [3]<br>−0.25 deteriorating [4] | Flat regression line<br>(B = −0.03) |
| | P2 | N/A (69.2 ± 17.3) [2] | +2.5 improving [3]<br>−0.85 deteriorating [4] | Flat regression line<br>(B = −0.01) |
| | P3 | Stable [1]<br>Stable (72.5 ± 18.13) [2] | +12.5 improving [3]<br>+9.25 improving [4] | Positive regression line<br>(B = 0.18) |
| | P4 | Stable [1]<br>Stable (68.75 ± 17.19) [2] | +5 improving [3]<br>+3.7 improving [4] | Positive regression line<br>(B = 0.14) |
| Non-Peer Model Condition | P1 | Stable [1]<br>Stable (72.5 ± 18.13) [2] | −7.5 deteriorating [3]<br>+8.75 improving [4] | Flat regression line<br>(B = −0.06) |
| | P2 | Stable [1]<br>Stable (73.73 ± 18.44) [2] | +10 improving [3]<br>+2.5 improving [4] | Positive regression line<br>(B = 0.14) |
| | P3 | Stable [1]<br>Stable (72.5 ± 18.13) [2] | +15 improving [3]<br>+10 improving [4] | Strong Positive regression line<br>(B = 0.36) |
| | P4 | Stable [1]<br>Stable (67.5 ± 16.88) [2] | +17.5 improving [3]<br>+8.75 improving [4] | Positive regression line<br>(B = 0.24) |
| Baseline 2 | P1 | Not enough data points. | +10 improving [3] | / |
| | P2 | N/A (67.5 ± 16.88) [2] | +2.5 improving [3] | |
| | P3 | Stable [1]<br>Stable (77.5 ± 19.38) [2] | −5 deteriorating [3] | |
| | P4 | Unstable [1]<br>Stable (67.5 ± 16.88) [2] | +5 improving [3] | |

[1] Stability Criteria 1: ≥3 data points with ≤10% variability, [2] Stability Criteria 2: 80% of data points are within stability envelope = median ± 25%, [3] Change in absolute level, [4] Change in relative level, [5] Trend line calculated using least-square linear regression.

**Table 3.** Between-phase analyses including level and overlap for self-efficacy-as-capability.

| Self-Efficacy-as-Capability | | | | |
|---|---|---|---|---|
| **Conditions** | **Participants** | **Level** | **Mean Level Change [3]** | **Overlap** |
| Baseline 1<br>/Peer Model | P1 | −11 deteriorating [1]<br>−15.1 deteriorating [2] | −0.24 | 100% POD<br>0% PND |
| | P2 | +3.35 improving [1]<br>+2.5 improving [2] | −0.02 | 100% POD<br>0% PND |
| | P3 | +14.8 improving [1]<br>+9.6 improving [2] | +2.40 | 17% POD<br>83% PND |
| | P4 | +7.5 improving [1]<br>+2.5 improving [2] | −0.02 | 100% POD<br>0% PND |

**Table 3.** *Cont.*

| Self-Efficacy-as-Capability | | | | |
|---|---|---|---|---|
| **Conditions** | **Participants** | **Level** | **Mean Level Change** [3] | **Overlap** |
| Peer Model /Non-Peer Model | P1 | −5 deteriorating [1]<br>+7.5 improving [2] | −0.08 | 50% POD<br>50% PND |
| | P2 | + 5 improving [1]<br>−5 deteriorating [2] | 1.38 | 17% POD<br>83% PND |
| | P3 | −9.05 deteriorating [1]<br>−12.5 deteriorating [2] | −0.15 | 100% POD<br>0% PND |
| | P4 | −7.45 deteriorating [1]<br>−12.5 deteriorating [2] | 0.39 | 60% POD<br>40% PND |
| Non-Peer Model /Baseline 2 | P1 | −7.5 deteriorating [1]<br>−10 deteriorating [2] | −0.31 | 100% POD<br>0% PND |
| | P2 | −7.5 deteriorating [1]<br>−7.5 deteriorating [2] | −1.54 | 100% POD<br>0% PND |
| | P3 | +3.75 improving [1]<br>+5 improving [2] | 1.21 | 100% POD<br>0% PND |
| | P4 | −1.25 deteriorating [1]<br>−15 deteriorating [2] | 0 | 67% POD<br>33% PND |

[1] Relative level change, [2] Immediacy effect shown by absolute level change, [3] Effect Size—Cohen's *d* (Small—0.3; Medium—0.5; Large—0.8). POD = Percent overlapping data; PND = Percent non-overlapping data.

### 3.2. *Self-Efficacy-as-Motivation*

**Overall Within-Phase Analysis.** For detailed information regarding the variability/stability, level, and trend analyses for each participant, see Table 4. Overall, Participant 1 had variable data at Baseline 1 and 2, while some level metrics appeared to change within the peer model condition, but the trend lines did not support a strong slope. Missing data points likely hindered strong trends and may have partially caused high variability. Participant 2 had stable Baselines scores, and experience change in the peer model condition in self-efficacy-as-motivation as per both level change metrics and a strong positive trend. Data were highly variable in the non-peer model condition and the metrics did not support any change. Participant 3 also had stable data at both Baselines and appeared to have increased their self-efficacy-as-motivation only in the non-peer model conditions with large level change metric scores and a positive trend line. Participant 4 had relatively stable data, especially at Baseline 2, and a positive trend accompanied by positive absolute and relative level changes in the non-peer model condition. No important changes appeared within the peer model condition. In summary, two out of four participants reported an increase in self-efficacy-as-motivation within the non-peer model condition. Moreover, one participant had an increase within the peer model condition.

**Overall Between-Phase Analysis.** For detailed information regarding the relative and mean level change and overlap analyses, see Table 5. For Participant 1, the peer model and non-peer model conditions differed the most as most metrics from the level and overlapping analyses tended to show higher response in the non-peer model condition. There was also a decrease in mean level between Baseline 1 and the peer model condition, however with the unstable Baseline 1 data found in the within analysis, this results in inconclusive. Participant 2 had a mean level decrease between Baseline 1 and the peer model condition, followed by an increase in the non-peer model condition. Participant 3 has a large level increase between Baseline 1 and the peer model condition according to all metrics and 100% of the data in the peer model phase being non-overlapping. Data then stabilized in the non-peer model condition and remained around the same level at Baseline 2. Participant 4 had almost no change in mean level throughout all four conditions. Small differences in absolute level change could be noted between the peer model and non-peer model conditions and between the non-peer model condition and Baseline 2. Overall, only one out of four participants had between-level changes in self-efficacy-as-motivation for the peer model condition when compared with Baseline 1. Two out of four participants had higher self-efficacy-as-motivation for the non-peer compared to the peer model.

**Table 4.** Within-phase analyses including variability/stability, level, and trend for self-efficacy-as-motivation.

| Self-Efficacy-as-Motivation | | | | |
|---|---|---|---|---|
| **Conditions** | **Participant** | **Variability/Stability** | **Level** | **Trend [5]** |
| Baseline 1 | P1 | Unstable [1]<br>Unstable (68 ±17) [2] | −44 deteriorating [3] | / |
| | P2 | Stable [1]<br>Stable (64 ± 16) [2] | −4 deteriorating [3] | |
| | P3 | Unstable [1]<br>Unstable (40 ± 10) [2] | 0 change [3] | |
| | P4 | Stable [1]<br>Stable (64 ± 16) [2] | −2 deteriorating [3] | |
| Peer Model Condition | P1 | Stable [1]<br>Stable (51.5 ± 12.88) [2] | +13 improving [3]<br>+11.5 improving [4] | Relatively flat regression line (B = 0.09) |
| | P2 | Stable [1]<br>Stable (57.5 ± 14.38) [2] | +11.5 improving [3]<br>+9.75 improving [4] | Positive regression line (B = 0.24) |
| | P3 | Stable [1]<br>Stable (62 ± 15.5) [2] | +3 improving [3]<br>+1.5 improving [4] | Flat regression line (B = 0.05) |
| | P4 | Stable [1]<br>Stable (66 ± 16.5) [2] | +1.5 improving [3]<br>+1.5 improving [4] | Relatively flat regression line (B = 0.08) |
| Non-Peer Model Condition | P1 | Stable [1]<br>Stable (63 ± 15.75) [2] | −2 deteriorating [3]<br>+3 improving [4] | Flat regression line (B = 0.02) |
| | P2 | Stable [1]<br>Stable (66 ± 16.5) [2] | −2 deteriorating [3]<br>+10 improving [4] | Relatively flat regression line (B = 0.07) |
| | P3 | Stable [1]<br>Stable (62 ± 10) [2] | +6 improving [3]<br>+10 improving [4] | Positive regression line (B = 0.18) |
| | P4 | Stable [1]<br>Stable (68 ± 17) [2] | +16 improving [3]<br>+10 improving [4] | Positive regression line (B = 0.24) |
| Baseline 2 | P1 | Not enough data points. | −10 deteriorating [3] | / |
| | P2 | Stable [1]<br>Stable (66 ± 16.5) [2] | +2 improving [3] | |
| | P3 | Stable [1]<br>Stable (64 ± 16) [2] | +2 improving [3] | |
| | P4 | Stable [1]<br>Stable (68 ± 17) [2] | 0 change | |

[1] Stability Criteria I: ≥3 data points with ≤10% variability, [2] Stability Criteria II: 80% of data points are within stability envelope = median ± 25%, [3] Change in absolute level, [4] Change in relative level, [5] Trend line calculated using least-square linear regression.

**Table 5.** Between-phase analyses including level and overlap for self-efficacy-as-motivation.

| Self-Efficacy-as-Motivation | | | | |
|---|---|---|---|---|
| **Conditions** | **Participants** | **Level** | **Mean Level Change** [3] | **Overlap** |
| Baseline 1 /Peer Model | P1 | −4 deteriorating [1]<br>+12 improving [2] | −0.37 | 100% POD<br>0% PND |
| | P2 | −12 deteriorating [1]<br>−16 deteriorating [2] | −1.60 | 100% POD<br>0% PND |
| | P3 | +26 improving [1]<br>+22 improving [2] | 4.22 | 0% POD<br>100% PND |
| | P4 | +1 improving [1]<br>+4 improving [2] | 0.26 | 83% POD<br>17% PND |
| Peer Model /Non-Peer Model | P1 | +4.5 improving [1]<br>+9 improving [2] | 2.09 | 25% POD<br>75% PND |
| | P2 | +3.25 improving [1]<br>+6.5 improving [2] | 1.69 | 50% POD<br>50% PND |
| | P3 | −3.5 deteriorating [1]<br>−7 deteriorating [2] | 0 | 100% POD<br>0% PND |
| | P4 | −4.5 deteriorating [1]<br>−9.5 deteriorating [2] | 0.46 | 67% POD<br>33% PND |
| Non-Peer Model /Baseline 2 | P1 | −0.75 deteriorating [1]<br>+7.5 improving [2] | 0.45 | 50% POD<br>50% PND |
| | P2 | −9 deteriorating [1]<br>+4 improving [2] | −0.28 | 100% POD<br>0% PND |
| | P3 | −4 deteriorating [1]<br>0 change | 0.44 | 100% POD<br>0% PND |
| | P4 | −4 deteriorating [1]<br>−6 deteriorating [2] | 0.15 | 100% POD<br>0% PND |

[1] Relative level change, [2] Immediacy effect shown by absolute level change, [3] Effect Size—Cohen's *d* (Small—0.3; Medium—0.5; Large—0.8). POD = Percent overlapping data; PND = Percent non-overlapping data.

## 4. Discussion

The purpose of this study was to compare changes in exercise self-efficacy levels among adults recovering from a stroke participating in an 18-week community-based exercise program who were exposed to three conditions in the following order: ($A_1$) no model (3 weeks); (B) peer model (6 weeks); (C) non-peer model (6 weeks); and ($A_2$) no model again (3 weeks). Our results showed that participants preferred having a model to demonstrate the exercises, with a slight preference for the non-peer model. Our findings may help expand research on modelling and model similarity in populations with stroke or physical disabilities. Our data showed that there were increases in self-efficacy despite the model type. There is previous support for the use of modelling in populations with physical disabilities and stroke through peer support studies [16,30,31] and from qualitative studies pinpointing modelling as an important component of rehabilitation programs [32]. Even though we recruited participants who had all taken the program in the past and had experience with exercise, we still saw increases in self-efficacy, with the exception of Participant 1, who appeared to have more experience with exercise. Overall and with most participants, these findings hint that modelling in this study may be at work because participants had already accumulated past experience (i.e., the strongest source of self-efficacy [10]).

Contrary to our expectations, only one participant preferred the peer model over the non-peer model in our study. Research suggests that individuals are inspired by the success of seeing a peer successfully accomplish a task [17,32]. Thus, our findings may hint that model similarity (i.e., how similar the model is to the observer) might not be as important for populations with physical disabilities. In fact, the non-peer model seems to have been more effective for enhancing self-efficacy compared to the peer model. Based on anecdotal notes from the researcher, it could be that model similarity was not the only factor at play; personal preferences, physical activity background, and more time in the class might have been contributing factors. Further, the non-peer model was a student in physical and health education with a strong physical activity background. They may have demonstrated the activity with more precision or participants may have found him a better leader. In fact, research has found identity leadership can have great influence on group engagement [33]. which could impact self-efficacy. All our participants described the non-peer model as more engaging than the peer model, suggesting that leadership and communication style may matter as much or more than model similarity.

When observing the levels of self-efficacy, self-efficacy-as-capability scores were consistently higher than self-efficacy-as-motivation scores for three out of the four participants. This observation aligns with the self-efficacy measurement arguments put forward by Williams and Rhodes [18]. Specifically, when individuals consider their motivation in their self-efficacy judgements (e.g., overcoming barriers to exercise), they rate their self-efficacy lower. We do acknowledge that the self-efficacy scales assessed different types of self-efficacy (task vs. barrier) which may also impact the scores. However, this result highlights that when measuring self-efficacy, researchers should be cognizant as to how they are assessing it to be able to report whether they are looking to changes to self-efficacy-as-capability or self-efficacy-as motivation.

### *4.1. Implications for Community Organizations and Lessons Learned*

Both modelling conditions seemed to have increased and/or maintained participants' self-efficacy levels, despite the type. As such, community organisations could implement models in their programs to help increase self-efficacy. From these results, they may opt for a non-peer model; however, a peer model would not necessarily negatively impact one's self-efficacy. Given that this study only provides a first examination on the impact of models and model similarity within a community-based group exercise program for stroke survivors, community programs could consult with group members on the type of model they would prefer and how to best integrate them into the class. The availability of peer or non-peer volunteers is also a potential benefit for community groups. Several experienced adults with physical disabilities are training in centres in which volunteers could be identified. Further, undergraduate students and programs in kinesiology, physical education, or other health domains may look for volunteer or internship opportunities to gain or provide valuable real-world experience in an exercise setting. The research findings from this study offer community organisations preliminary scientific evidence for including modelling in their programs, with no indication that one type of model is more advantageous.

Despite our partner's efforts to recruit new members to their program and introduce new exercises every class, the beginner level course comprised past participants. This may have influenced higher self-efficacy levels from the onset. Although we attempted to manipulate self-efficacy (a BCT) to answer recent calls in the literature [14], attempting to undertake such an experimentation in a real-world setting is challenging. Given our research was conducted in an existing community-based program, we opted to lose some internal validity for gains in external/ecological validity. As such, we did not interfere with how the program ran or remind participants to attend the sessions. Additionally, we had little control over the length of the program and frequency/duration of sessions. In working with the community, researchers need to relinquish control and work with the community to identify how they can meet their needs [34]. In our case, a researcher was present at every session to assist with data collection and, after encountering a missed session by a model, a researcher took on the responsibility to remind the models to attend the session. Given we still had some results in a real-world setting, models may be an effective method to increase self-efficacy.

With the challenges of experimentation in real-world settings, we suggest that researchers use varying methodologies and document their implementation (e.g., researcher diaries). Having detailed implementation information such as researcher diaries could provide nuance that is not necessarily captured with quantitative data. Another suggestion for researchers working in community-based settings is to have meetings early on with community representatives about different methodologies and designs that can be used [35]. Not only should there be discussions around efficacy, but also feasibility in that specific setting. Lastly and most importantly, we suggest that researchers establish constant communication with their community partner to ensure quick adaptations when needed [36]. As we learned, our study protocol needed to be adjusted a few times due to unpredictable circumstances.

### *4.2. Limitations*

Our study it is not without limitations. We acknowledge the limitations of having a high attrition rate and low sample size of four participants, with three of seven participants dropping out of the program due missing sessions (e.g., non-exercise related injury/illness). Having a lower sample size makes it difficult to interpret the findings and generalise to other samples. However, we believe our results lay the foundation for future studies aiming to examine this phenomenon. Additionally, we were not able to run the study in both orders and in two different weekly classes as intended (ABCA and ACBA) or have a control group for comparison. High attrition rates are typical in research with people with physical disabilities and in real-world research [37,38]. As a result, researchers and community organisations need to continue to work together to identify strategies to maximise participant engagement that is specific to that local context with the goal of minimising attrition.

## 5. Conclusions

Our study provides insight into the pragmatics of conducting research in a community setting. Three of the four participants showed increased self-efficacy in at least one condition, with two participants demonstrating improvement in the non-peer model condition, suggesting its potential effectiveness. However, the findings were not consistent across all participants. Nonetheless, the results indicate that modelling, in general, may benefit stroke survivors in increasing their self-efficacy.

**Supplementary Materials:** The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/disabilities4010013/s1, Figure S1: Self-efficacy-as-capability for participant 1; Figure S2: Self-efficacy-as-motivation for participant 1; Figure S3: Self-efficacy-as-capability for participant 2; Figure S4: Self-efficacy-as-motivation for participant 2; Figure S5: Self-efficacy-as-capability for participant 3; Figure S6: Self-efficacy-as-motivation for participant 3.

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