Education of Teachers with Chronic Low Back Pain Based on Integrative Model of Behavioral Prediction

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Abstract

**Background:** Individuals suffering from chronic low back pain (CLBP) experience major physical, social, and occupational disruptions. Strong evidence confirms the effectiveness of Alexander technique (AT) training for CLBP.

**Objectives:** The present study applied an integrative model of behavioral prediction (IM) to design AT training for education of teachers with CLBP.

**Methods:** This was a quasi-experimental study conducted on female teachers with non-specific LBP in southern Tehran in 2014. The intervention group consisted of 42 teachers (AT training based on IM) and the control group included 35 teachers (AT training only). The validity and reliability of the 108-item AT questionnaire based on IM constructs were confirmed using content validity (CVR 0.87, CVI 0.96) and Cronbach’s $\alpha$ (0.84). Data were analyzed by Independent and Paired Sample t-test, Mann-Whitney U test, Wilcoxon, and covariance.

**Results:** The results of the study indicated that AT behaviors, skills and abilities, direct and indirect perceived behavioral control, indirect subjective norms, direct and indirect attitude, and perceived risk were higher in the intervention group three months after the intervention (all P values < 0.05). Disability score ($P < 0.001$), hand to floor test ($P = 0.023$), and pain frequency ($P = 0.022$) showed a significantly higher reduction in the intervention group.

**Conclusions:** The IM educational framework coupled with AT training may facilitate applying AT directions and finally lead to pain reduction in CLBP.

**Keywords:** Complementary Treatment, Educational Model, Low Back Pain, Teachers

1. Background

Chronic low back pain (CLBP) is a source of great physical disability, role impairment, diminished psychological well-being, and low quality of life (1). In fact, CLBP is characterized by pain in the region between the costal margins and the inferior gluteal fold, with or without referred pain in the lower limbs, lasting more than 12 weeks (2). The majority of LBP patients (80% - 90%) suffer from non-specific LBP, leading to considerable pain-related disability, which is associated with no clear structural or anatomical reason. However, it causes limitation in daily activities due to actual pain (3). LBP has been one of the leading causes of years lost due to disability (YLD) counts. The geographical variation rate of YLD causes among countries in 2017 showed that LBP was the leading cause in 126 of 195 countries and territories (4).

LBP is a common symptom and an important cause of disease burden in Iran, in particular, in the most productive age of both genders. Epidemiologic data related to LBP are sparse from developing countries, especially Iran (5). The prevalence of musculoskeletal disorders (MSD) in school teachers is between 40% and 95%. Factors such as age, job experience, gender, long time staying in specific position, head-down posture for instance, in reading, grading papers and writing on a blackboard, and awkward posture are some of MSD causes (6). The American College of Physicians (ACP) guideline recommended initially selecting non-pharmacologic treatment for CLBP (7).
Although most CLBP patients are managed using interventions having unreliable scientific effectiveness evidence such as massage, acupuncture, manipulation (7, 8), a systematic review in 2012 concluded that Alexander technique (AT) has a strong effect on CLBP. Its effectiveness is more than exercise and massage (9). Indeed, AT is an educational method, which is helpful for coordination of posture and regulates the relationship between head, neck, and back (10). In health education, understanding intermediate factors other than knowledge by applying theories may cause successful behavioral changes (11).

Theory of reasoned action (TRA) and planned behavior (TPB) constructs such as perceived risk, self-efficacy, and behavioral beliefs are considered during the CLBP management (12), the prediction of doing exercise in people suffering from LBP, assessing patients’ views about AT, and observing the proper posture (13). The intention can predict the behavior accompanied by supporting environmental factors (14). To choose appropriate model, health educators are recommended to consider the topic, type of the behavior, target group, models applied in previous successful programs, and models supported through previous research in the same area or related areas (15).

Hence, this study employed integrative model of behavioral prediction (IM). In this regard, Intention is determined by some combination of attitudes, perceived normative pressure, and/or perceived control over the behavior and also constructs such as skills and environmental constraints effects on performing or not performing the behavior (16). The behavioral intention has been predicted by IM in cancer self-examination and screening, vegetable and fruit consumption, and stopping the smoking and being female. Exclusion criteria involved malignancy history, vertebral column infection or fractures, spinal surgery and congenital abnormality, severe postural deformity, confirmed spondylolysis, rheumatoid arthritis, osteoporosis, and pregnancy, referring pain to leg inability to walk more than 100 m, numbness or pins-and-needles feelings in the feet or toes, morning stiffness lasting more than 30 minutes, difficulty in walking on the toes and heel, positive straight leg rising (SLR) test in 70 angles, no pain reduction after resting, and pregnancy. Initially, 86 patients were recruited. Nine patients about 10 percent drop up, one from the intervention group and eight from the control group. Subsequently, 42 and 35 patients were assigned to the intervention and control groups, respectively.

2.1. Sample Size

According to the below formula and considering \( \alpha = 5\% \), 90% statistical power, \( d = 0.6 \) (moderate effect size), using the following formula, and 15% sample drop out; the sample size was calculated 35 patients for each group.

\[
 n = \frac{(Z_{\alpha/2} + Z_{\beta/2})^2}{d^2} = \frac{10.49 \times 0.36}{0.6} = 29.13 \sim 30
\]

2.2. Study Instruments

An elicitation study by interviewing 15 eligible teachers from the target group was conducted to design the IM construct questionnaires. Themes were labeled according to the IM constructs, and self-report AT questionnaire were prepared based on them. Following the assessment of 11 experts in health education and promotion, occupational medicine specialist and research specialist, the score of 0.87 was calculated for content validity ratio (CVR) by applying the Lawshe table, 0.96 for content validity index (CVI), and 0.84 for internal consistency Cronbach’s \( \alpha \). The opinions of 25 eligible teachers about the clarity of the items were applied for evaluating face validity.

The 108-item AT questionnaire included demographic information and 15 IM constructs such as knowledge, perceived risk, and so on. Likert scale rated on a 1 to 7 was applied for inquiries, except for knowledge items, which
offered true-false or “do not know” responses and behavior items, which offered 5 = always to 1 = never. Skill assessment checklist included a total of 18 items considering the two fundamental AT lessons: getting up from the chair and picking up light objects, which were evaluated observationally. The Farsi version of the Roland-Morris disability questionnaire (19), which has a 24 list of daily activities, The hand to floor test (Rozenstock L 2005) (20), and visual analog scale were also employed (21).

2.3. Educational Plan
A 90-page booklet and a CD about inhibition and directions rehearsals were provided for both groups. Table 1 shows the educational plan. The lessons were based on the IM constructs and intervention mapping instructions in the intervention group (22, 23). The technique used to improve IM constructs have been previously reported (24), and the others are available in Table 1.

2.4. Ethical Considerations
The Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran, approved the study (Letter Number: P/17/1/187844 in December 21, 2013). Verbal consent was obtained. The visits to schools and holding of AT sessions were authorized by the educational authorities of Tehran Province.

2.5. Statistical Analysis
All statistical analyses were carried out by SPSS V.16. For statistical analysis, Independent and Paired Sample t-test, Mann-Whitney, chi-square, Wilcoxon, and covariance were used.

3. Results
In two groups, 77 teachers were assessed. Table of demographic characteristics of the participants and the comparison of them, as well as table of other variables such as age, work experience, education, marital status, Roland-Morris and pain score, duration of LBP, and IM constructs have been reported (24, 25). Regarding these constructs and variables, no baseline differences were observed between the groups by the t-test and Mann-Whitney U test (All P values > 0.05). The mean scores of the seven IM constructs before the intervention are shown in Tables 2 and 3.

Three months after the intervention, the changes in all IM constructs in both intervention and control groups were significant (P < 0.05), except for perceived environmental constraints, which was not improved in both groups (P = 0.869). However, in the intervention group, covariance test results revealed more significant improvements on all IM constructs, except for the constructs of knowledge (P = 0.210), direct normative belief (P = 0.279), environmental constraint (P = 0.869) and intention (P = 0.080) in which both groups were improved similarly.

The improvement in “pain score” and “frequency of pain” in both groups was strongly significant. However, Roland-Morris score (P = 0.006) and hand to floor test (P < 0.001) were improved only in the intervention group (Table 4). Covariance test revealed more significant improvement in all of the above-mentioned outcomes in the intervention group, except for pain score (P = 0.086), which showed a similar improvement in this outcome in both groups.

4. Discussion
This study investigated the education of teachers with CLBP based on AT lessons coupled with IM three months after the intervention. The results showed that teacher educational plan in the intervention group facilitated the adoption of AT behaviors and fostered skills and abilities, direct and indirect perceived behavioral control, indirect subjective norms, direct and indirect attitude, and perceived risk in comparison to the control group. Consistent with this result, it was established that merely providing knowledge and messages alone “As in AT training, so far has been common” is not enough to change behavior (11).

Also, the frequency of pain and disability decreased in the intervention group compared with the control group, which was objectively confirmed by hand to floor test. These results indicated that the IM strengthened the AT training. The environmental constraint was the only construct that did not change in both groups. Fishbein stated changing environmental factors can include community engineering or training for people to avoid environmental barriers (16). Consistent with these findings, Cardoso study showed a high prevalence of LBP in teachers and recommended advocacy for the improvement of the environmental condition (26). Adequate and standardized furniture are considered to improve upright posture in AT training (27).

Knowledge, direct subjective norms, and intention constructs were improved in both groups. The control group improvement could be attributed to receiving three sessions of AT training. Yardley et al. study showed participants in 6-session AT training classes did not show changes in perceived behavioral control, but participants in 24-session training classes made progression in attitude and
Table 1. The Intervention Plan in Both Intervention and Control Groups

| Group                        | Education for Control Group                                      | Education for Intervention Group                           |
|------------------------------|------------------------------------------------------------------|-------------------------------------------------------------|
| Session number               | Three sessions (just AT lessons)                                 | 5 sessions in 1.5 hours for intervention group performed. (AT lessons coupled with IM) |
| Trainers                     | A health education specialist, a physical medicine and rehabilitation specialist, and a physiotherapist | A health education specialist, a physical medicine and rehabilitation specialist, and a physiotherapist |
| Educational package          | One DVD and a 90-page booklet about AT lessons                    | One DVD and a 90-page booklet about AT lessons, A checklist of self-assessment, a checklist of posture assessment, a page of early commitment, Two poster reminders for installation on the wall of the house, three poster reminders for installation on the walls of the training place (classroom) and its corridors |
| Common educational methods and equipment | Lectures, demonstrations, questions and answers (Q&A), Equipment: photos, video projector, chair, desk, mirror, pillow, bed, and model of the spine | Similar to control group |
| Content of sessions          | Definition of LBP and its etiology, the origin of the AT, principals of AT, how to do exercise, self-assessment, work with chair, monkey position, daily activity, rehearsal of back muscles relaxation | Technique and methods such as enhance perceived risk, knowledge, shape and change attitude, improve perception of environmental constraints and change environment, change habitual behavior, skills and abilities, self-efficacy and overcoming barriers, and also techniques used to change perception of subjective norms. Discussion and role-playing sessions in addition to all interventions in control group were also used. |
| Following                    | Four notifications of SMS                                        | Fifteen persuasive SMS every week, 4 notifications of SMS, Telephone call after one and half month to follow |

*Techniques used to increase skills and abilities, self-efficacy and overcoming barriers in intervention group: Teaching methods: lecture, Q&A, role-playing. Equipment: photos, video projector. Early commitment, self-monitoring or personal supervision, dividing behavior in to smaller behaviors, verbal encouragement, attribution, role-playing, remove and overcoming barriers, modeling, guided practice, setting short-term and long-term goals.

**Techniques to change perception of subjective norms in intervention group: Information about the other agreements (specialist, health director of district, giving OJT certification), social comparison, training them in 10-individual groups.

Table 2. Comparison of IM Constructs (Knowledge, Perceived Risk, Attitude, Subjective Norm) Before and After the Intervention Between the Two Groups

| Evaluated IM Constructs, Group | Before Intervention | After Intervention | P Valuea | P Valueb (Between the Two Groups) |
|--------------------------------|---------------------|--------------------|----------|-----------------------------------|
| Knowledge                      | 0.210               |                    |          |                                   |
| Intervention                   | 1.320 ± 0.260       | 8.394 ± 0.321      | < 0.001  |                                   |
| Control                        | 0.850 ± 0.213       | 8.062 ± 0.327      | < 0.001  |                                   |
| P value                        | 0.31                | 0.472d             |          |                                   |
| Perceived risk                 | 0.032               |                    |          |                                   |
| Intervention                   | 29.134 ± 1.198      | 34.952 ± 1.352     | < 0.001  |                                   |
| Control                        | 28.500 ± 1.450      | 32.628 ± 1.179     | 0.024    |                                   |
| P value                        | 0.92d               | 0.032              |          |                                   |
| Direct attitude                | 0.001               |                    |          |                                   |
| Intervention                   | 34.771 ± 1.105      | 53.950 ± 0.623     | < 0.001  |                                   |
| Control                        | 32.771 ± 0.547      | 48.628 ± 1.080     | < 0.001  |                                   |
| P value                        | 0.20                | 0.001              |          |                                   |
| Behavioral belief χ (outcome evaluation) | 0.029               |                    |          |                                   |
| Intervention                   | 54.809 ± 5.342      | 104.928 ± 0.633    | < 0.001  |                                   |
| Control                        | 44.451 ± 4.341      | 89.54 ± 1.080      | < 0.001  |                                   |
| P value                        | 0.017d              | 0.021d             |          |                                   |
| Directive subjective norm      | 0.279               |                    |          |                                   |
| Intervention                   | 17.023 ± 3.072      | 20.928 ± 3.405     | < 0.001  |                                   |
| Control                        | 16.400 ± 1.718      | 19.942 ± 5.628     | < 0.001  |                                   |
| P value                        | 0.266               | 0.278d             |          |                                   |
| Normative belief χ (motivation to comply) | 0.025               |                    |          |                                   |
| Intervention                   | 16.047 ± 4.549      | 20.928 ± 0.503     | < 0.001  |                                   |
| Control                        | 5.857 ± 3.084       | 19.942 ± 0.625     | < 0.001  |                                   |
| P value                        | 0.068               | 0.003e             |          |                                   |

aPaired t-test and Wilcoxon.
bCovariance.
c t-test and Mann-Whitney.
dUsing parametric tests.
Table 3. Comparison of IM Constructs (Behavioral Control, Skills and Ability, Environmental Constraint, Intention, Behavior) Before and After the Intervention Between the Two Groups

| Evaluated IM Constructs, Group | Before Intervention | After Intervention | P Value<sup>a</sup> | P Value<sup>b</sup> (Between the Two Groups) |
|-------------------------------|---------------------|--------------------|---------------------|---------------------------------------------|
| Directive perceived behavioral control |                     |                    |                     |                                             |
| Intervention                  | 16.357 ± 0.317      | 22.595 ± 4.472     | < 0.001             |                                             |
| Control                       | 16.371 ± 1.416      | 19.857 ± 4.653     | < 0.001             |                                             |
| P value<sup>c</sup>           | 0.892               | 0.010<sup>d</sup>  |                     |                                             |
| Control belief (their perceived power to influence behavior) |                     |                    |                     |                                             |
| Intervention                  | 7.357 ± 4.372       | 25.623 ± 6.362     | < 0.001             |                                             |
| Control                       | 4.521 ± 2.559       | 27.071 ± 4.474     | < 0.001             |                                             |
| P value<sup>c</sup>           | 0.208               | < 0.001            |                     |                                             |
| Environmental constraint      |                     |                    |                     |                                             |
| Intervention                  | 26.466 ± 0.911      | 26.523 ± 0.917     | < 0.001             |                                             |
| Control                       | 26.000 ± 1.004      | 26.257 ± 1.017     | < 0.001             |                                             |
| P value<sup>c</sup>           | 0.902<sup>e</sup>   | 0.853<sup>d</sup>  |                     |                                             |
| Skills and abilities          |                     |                    |                     |                                             |
| Intervention                  | 1.345 ± 0.206       | 7.254 ± 4.500      | < 0.001             |                                             |
| Control                       | 1.472 ± 0.224       | 2.237 ± 0.240      | 0.003               |                                             |
| P value<sup>c</sup>           | 0.581               | < 0.001            |                     |                                             |
| Intention                     |                     |                    |                     |                                             |
| Intervention                  | 17.666 ± 0.587      | 25.976 ± 0.533     | < 0.001             |                                             |
| Control                       | 16.857 ± 0.487      | 24.542 ± 0.533     | < 0.001             |                                             |
| P value<sup>c</sup>           | 0.11                | 0.008              |                     |                                             |
| Behavior                      |                     |                    |                     |                                             |
| Intervention                  | 30.357 ± 0.800      | 57.595 ± 1.569     | < 0.001             |                                             |
| Control                       | 32.714 ± 0.879      | 50.914 ± 1.271     | < 0.001             |                                             |
| P value<sup>c</sup>           | 0.051               | 0.002              |                     |                                             |

<sup>a</sup>Paired t-test and Wilcoxon.  
<sup>b</sup>Covariance.  
<sup>c</sup>t-test and Mann-Whitney.  
<sup>d</sup>Using parametric tests.

Table 4. Comparison of Pain Outcome Before and After the Intervention Between the Two Groups

| Evaluated Outcome, Group | Before Intervention | After Intervention | P Value<sup>a</sup> | P Value<sup>b</sup> (Between the Two Groups) |
|--------------------------|---------------------|--------------------|---------------------|---------------------------------------------|
| Pain score               |                     |                    |                     |                                             |
| Intervention             | 5.178 ± 0.227       | 3.190 ± 0.243      | < 0.001             |                                             |
| Control                  | 5.235 ± 0.267       | 3.971 ± 0.305      | 0.002               |                                             |
| P value<sup>c</sup>      | 0.85                | 0.061              |                     |                                             |
| Frequency of occurrence of pain in the last three months |                     |                    |                     |                                             |
| Intervention             | 11.571 ± 2.708      | 1.738 ± 0.259      | 0.001               |                                             |
| Control                  | 14.730 ± 2.372      | 5.142 ± 0.939      | 0.001               |                                             |
| P value<sup>c</sup>      | 0.70                | < 0.001            |                     |                                             |
| Roland Morris score      |                     |                    |                     |                                             |
| Intervention             | 4.714 ± 0.621       | 3.881 ± 0.452      | 0.006               |                                             |
| Control                  | 7.235 ± 0.758       | 6.714 ± 0.621      | 0.598               |                                             |
| P value<sup>c</sup>      | 0.126               | < 0.001            |                     |                                             |
| Hand to floor test       |                     |                    |                     |                                             |
| Intervention             | 8.095 ± 1.509       | 2.428 ± 0.628      | 0.001               |                                             |
| Control                  | 7.942 ± 1.511       | 5.457 ± 1.312      | 0.271               |                                             |
| P value<sup>c</sup>      | 0.85                | 0.036              |                     |                                             |

<sup>a</sup>Paired t-test and Wilcoxon.  
<sup>b</sup>Covariance.  
<sup>c</sup>t-test and Mann-Whitney.  
<sup>d</sup>Using parametric tests.
perceived behavioral control after three months, while both groups did not show progress in the intention (13).

Some IM constructs in the intervention group progressed compared to the control group. This improvement in constructs facilitated behavior adoption better than the control group, which declines LBP and can be attributed to applying IM based training by using different methods to enhance IM constructs. Fishbein, and Bartholomew and Mullen stated that in IM and other models, there is no discussion on how to change constructs (16, 28). Consistent with our study, Woodman et al. reported patients that participated in AT class indicated significant improvements in most self-efficacy/self-care measures compared with usual care alone (29). Bleakly et al. indicated attitude as the most important predictor of the behavior and mentioned skills, abilities, and environmental constraints are not mostly measured in IM-used studies (30).

Pain score significantly decreased in both groups, but the frequency of the pain occurrence was less in the intervention group. It means that the intervention group experienced less LBP frequency of occurrence than the control group; regardless of showing the same pain severity as control group each time. Reddy in his study reported more skill, decrease in pain, and better posture after six AT training sessions (31). Little et al. revealed that AT courses are more effective than massage and exercise and have long-term benefits for LBP (32). Consistent with the current study, in a study, 60% of participants indicated significant improvement in pain condition by employing AT in a longer follow-up period (32). LBP disability and hands to floor test decreased significantly just in the intervention group. Studies declared that hand to floor test can be used as a sensitive and objective index (33).

These results explicit the use of IM to promote adherence to AT and also cost-effectiveness and feasibility of employing AT in developing countries. In Hue et al. study in 2015, it was stated that AT training coupled by exercise, created more cost-effectiveness (34). However, it is necessary to maintain motivation by providing personal support and texting persuasive SMSs or reminder classes. The limitations of the study can be considered self-reported of behavior and small-sample size, teaching AT by a teacher without a certificate, more comprehensive research must be undertaken more cost-effectiveness (34). However, it is necessary to maintain motivation by providing personal support and texting persuasive SMSs or reminder classes.

4.1. Conclusions

Because of fewer adverse reactions in complementary treatments, AT application is highly recommended in developing or developed countries by using the methods described in the present study.

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Footnotes

Authors’ Contribution: Study design: Tahereh Kamalikhah, Leila Sabzmakan, Hassan Okati-Aliaabadi, Fatemeh Rahmati-Najarkolaee, and Nooshin Rouhani-Tonekaboni; acquisition of data, analysis, and interpretation of data: Tahereh Kamalikhah; drafting the article or revising: Tahereh Kamalikhah, Fatemeh Rahmati-Najarkolaee, and Nooshin Rouhani-Tonekaboni. All of the authors corroboration final approval of the version to be submitted.

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Ethical Approval: The Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran, approved the study (letter number: P/17/1/187844 in December 21, 2013). Verbal consent was obtained before starting the classes. The visits to schools and holding of AT sessions were authorized by the educational authorities of Tehran province.

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Patient Consent: Verbal consent was obtained before starting the classes. The visits to schools and holding of AT sessions were authorized by the educational authorities of Tehran province.

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