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Development, Content Validation and Feasibility of the Tai-C Matte Steps: A Numbered Floor-Mat Programme for Teaching 24-Form Taijiquan to Physically Inactive College Students

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Abstract

Adaptations of Tai Chi for new learners have mostly shortened or changed the routine, and almost all have been developed for older or clinical groups. This study describes the development of the Tai-C Matte Steps, a numbered floor mat that lays out the foot placements of the standard 24-form Taijiquan for novice learners, and reports its content validity and implementation feasibility. Development followed a design and development research approach in five stages and is reported against the GUIDED and TIDieR checklists. The programme kept all 24 movements and comprised a two-row grid mat with three cell sizes (30, 35 and 40 cm) matched to body height, a four-stage lesson structure, and 24 supervised 60-minute lessons over 8 weeks with home practice. Five experts from the host institution rated 12 programme components on appropriateness, clarity, safety and feasibility in a single round (240 ratings). All ratings were 3 or 4 and 234 (97.5%) were 4, so every item-level and scale-level content validity index was 1.00. This ceiling shows that the panel accepted the programme; it does not show that the panel discriminated between components. Equipment and layout received the lowest mean rating (3.85), and the experts' comments led to stride-matched cell sizes, explicit use of the numbers as reference points within continuous movement, and clearer learning progression and assessment. In one class of 15 physically inactive college students, all participants completed the 8 weeks, attendance was 98.1% and self-reported home-practice completion was 98.1%; no adverse events were recorded. Feasibility criteria were not set in advance, so these results are descriptive. The Tai-C Matte Steps is a fully specified teaching programme that experienced local staff judged appropriate and that could be delivered in a college setting; whether it improves learning is a separate question addressed in a companion study.

Keywords: Tai Chi, Taijiquan, Intervention Development, Content Validity, Feasibility, Motor Learning, Physical Inactivity, University Students

Introduction

Physical inactivity is common worldwide: in 2016, 27.5% of adults did not meet the recommendation of at least 150 minutes of moderate-intensity activity per week (Bull et al., 2020; Guthold et al., 2018). University students accumulate more sedentary time than young adults in general, about 7 hours a day by self-report and nearly 10 hours by accelerometer (Castro et al., 2020). In China, national data show that physical fitness fell and overweight and obesity rose among college students between 2019 and 2023, with partial recovery in the final year (Sun & Cheng, 2026), and a four-year cohort found that fitness and exercise habits declined further over the undergraduate years (Lian et al., 2026). National policy has responded in two ways. The Healthy China 2030 outline calls for Taijiquan and other traditional sports to be promoted as part of national fitness (State Council of the People's Republic of China, 2016), and a 2020 national opinion on school physical education requires university students to meet the national physical health standard and complete their physical education credits before graduating, and directs schools to teach traditional Chinese sports such as wushu (General Office of the CPC Central Committee & General Office of the State Council, 2020). Tai Chi, a wushu discipline, is an aerobic exercise of mild-to-moderate intensity that is suited to community settings (Lan et al., 2013), and so fits both agendas.

The evidence that Tai Chi benefits students is moderate and mainly psychological. An early systematic review of 76 reports, most of them in Chinese and not limited to randomised trials, found likely benefits for flexibility, depressive symptoms, anxiety and interpersonal sensitivity (Webster et al., 2016). A recent meta-analysis of 12 randomised trials in college students reported reductions in depression (SMD −0.67), anxiety (SMD −0.79) and stress (SMD −0.40), with high heterogeneity for some outcomes (Zhong et al., 2026). The comparison condition matters, however: in a meta-analysis of traditional Chinese mind-body practices in university students, the effect on anxiety was large against no intervention (SMD −0.92) but negligible against an active control (SMD −0.09) (Liu et al., 2026). Physical effects are smaller and less consistent. A meta-analysis of randomised trials in participants aged 16 years and over found moderate improvements in handgrip strength, 6-minute walk distance, single-leg stance and thoracolumbar flexibility, and called for trials in younger healthy participants using a standardised routine (Wehner et al., 2021); in a randomised trial with 206 Chinese college students, 12 weeks of Tai Chi improved flexibility and balance but no other physical or psychological outcome (Zheng et al., 2015). One possibility, not yet tested, is that beginners spend much of a short programme learning the routine rather than practising it.

The standard 24-form Taijiquan (General Administration of Sport of China, 1999) requires the learner to recall 24 movements and their transitions while controlling stance, weight transfer, arm actions and breathing. Teachers and learners describe this as demanding. In university Tai Chi courses, the coordination demands and the need for sustained practice threaten students' engagement, and teachers rely on layered demonstration and protective feedback to build mastery and self-efficacy (Li & Fan, 2026); older learners also name the complexity of the movements as a barrier (Du et al., 2023). The premise of the present work is that much of the early difficulty is spatial: which foot moves, in which direction, how far, and where the body should face after a turn. Cognitive load theory predicts that holding such a route in working memory while attending to posture and breath can exceed what working memory allows (Sweller, 1988), and in Tai Chi observational learning, the format of a demonstration has been shown to change cognitive load and movement accuracy (Yang et al., 2026). Existing

learning aids have targeted movement form rather than the route of the feet. A scoping review of 34 Tai Chi training systems found mainly desktop, virtual-reality and sensor-based tools, of which only two had been tested for efficacy (Liu et al., 2025), and in older adults immersive virtual reality produced no better movement knowledge than matched video instruction (Song et al., 2026).

Adaptations of Tai Chi have mostly changed what is taught. Practitioners can perform a complete set or selected movements according to their needs (Lan et al., 2013), and programmes for older and clinical groups shorten the routine, select movements or add therapeutic exercises (Chen et al., 2020; Li, 2014; Li et al., 2018); some extract the footwork as separate training content (Mao et al., 2024). These approaches can work in those groups, but the learner no longer practises the standard routine, and the evidence on whether shorter or modified forms are preferable is mixed: a network meta-analysis in Parkinson's disease ranked the 24-form above two 8-form versions (Lei et al., 2022), whereas in adults over 55 a modified Chen-style routine of 18 movements produced larger gains than the 24-form (Zou et al., 2019). For students who are taught the standard routine in physical education, shortening it is not an option.

Before an effectiveness trial, a new intervention should be specified in enough detail to be replicated, checked with experts and shown to be deliverable in its intended setting (O'Cathain et al., 2019; Skivington et al., 2021). We found few such development studies for Tai Chi. One protocol for women with breast cancer was developed under the Medical Research Council framework and content-validated by six experts in a single round (Yao et al., 2021), but it specified the form and dose rather than a method of teaching. In Chinese college physical education, a bodyweight training module was developed through a two-round modified Delphi in which the experts excluded most of the candidate content (Cui et al., 2026). The present study applies this kind of development work to a method of teaching the standard routine.

The aim was therefore threefold: (a) to describe the development of the Tai-C Matte Steps and its 8-week teaching programme in line with the GUIDED and TIDieR checklists; (b) to evaluate its content validity with an expert panel; and (c) to describe its implementation in one class in terms of retention, attendance, home-practice completion, fidelity records and safety.

Methods

Study Design and Ethics

This paper reports the first phase of a two-phase doctoral project. The first phase followed a design and development research approach (Richey & Klein, 2007) to develop the Tai-C Matte Steps and establish its content validity before implementation. The second phase compared the programme with conventional Tai Chi instruction in a quasi-experimental study whose outcomes are reported separately; implementation records from the class that received the Tai-C Matte Steps are reported here. In that phase, two intact administrative classes were assigned to the two conditions according to class membership and timetable. After eligibility screening, 15 students were selected from the eligible students in each class (18 and 20) using a random-number table. This was random selection within classes, not random allocation between conditions.

Development followed the actions recommended by O'Cathain et al. (2019) and is reported against the GUIDED checklist (Duncan et al., 2020); the programme is described using the TIDieR template (Hoffmann et al., 2014). Because the implementation phase was not a randomised pilot trial, the CONSORT extension for pilot and feasibility trials was used only as guidance on what to report, as its authors suggest for non-randomised studies (Eldridge et al., 2016). Ethical approval was obtained from Sultan Idris Education University, followed by permission from the host institution, and the study was conducted in accordance with the Declaration of Helsinki (World Medical Association, 2025). All experts and participants gave written informed consent.

Development Process

The programme was developed in five stages: (1) identification of novice-learning problems from the literature and the theoretical framework; (2) mapping of the footwork and movement sequence of the standard 24-form Taijiquan (General Administration of Sport of China, 1999); (3) construction of the numbered-mat prototype and an 8-week lesson structure; (4) expert review of appropriateness, clarity, safety and feasibility; and (5) refinement of mat adaptability, movement continuity, learning progression and assessment procedures before implementation. Learners were not involved in the design. The target users were full-time undergraduates aged 18 to 23 years with no previous formal Tai Chi training who reported no more than two structured exercise sessions per week and less than 150 minutes of moderate-intensity activity per week. These two self-reported screening questions identify insufficient activity; they were not a validated activity questionnaire and did not measure sedentary time.

Three barriers to early learning were identified: the memory load of the sequence, uncertainty over foot placement and direction, especially after turns, and loss of motivation when progress is slow. Each barrier was matched to a design feature and a proposed mechanism (Table 1). Cognitive load theory suggests that moving the route from memory onto the floor should free attention for posture and breath (Sweller, 1988). The external-focus literature suggests that a visible floor target may support learning better than instructions about body position (Wulf, 2013), although a bias-corrected re-analysis found the average benefit of an external focus to be small (McKay et al., 2024), so this mechanism was treated as plausible rather than established. The stages of learning described by Fitts and Posner (1967) guided the progression from fully cued practice to performance without the mat, and self-determination theory suggests that early, visible success may support perceived competence and therefore intrinsic motivation (Ryan & Deci, 2000).

Table 1
Programme Theory of the Tai-C Matte Steps

Barrier for novice learners	Design feature of the mat and programme	Proposed mechanism	Expected proximal outcome
Holding a 24-movement route in memory	Foot placements of the routine printed on the floor as numbered cells	Route moved from working memory to the environment (Sweller, 1988)	Faster sequence acquisition; attention free for posture and breath
Unclear foot placement and left-right confusion	Each foot placement is a numbered cell; separate route lines for the left (blue) and right (red) foot; cell 0 is the start and reset point	External target for each step (Wulf, 2013); size of benefit uncertain (McKay et al., 2024)	Fewer stepping and orientation errors
Steps that do not fit the learner's body	Three cell sizes (30, 35 and 40 cm) matched to body height	Step length scaled to stride while the numbering stays constant	Comfortable stances and controlled weight transfer
Over-reliance on the mat and the instructor	Movement decomposition, then integration, then practice and performance off the mat	Progression from cognitive to associative stage (Fitts & Posner, 1967); withdrawal of guidance (Salmoni et al., 1984)	Independent recall of the full routine
Slow visible progress and dropout	Short pathways mastered first, then linked; four-stage lesson with reflection	Early mastery may support competence and intrinsic motivation (Ryan & Deci, 2000)	Attendance and home-practice adherence

Note. Mechanisms are proposed from theory and were not measured in this study. A floor target is also likely to draw the gaze downward (Domínguez-Zamora et al., 2018), which conflicts with the upright head position of Tai Chi; the staged withdrawal of the mat is partly a response to this.

The Tai-C Matte Steps Programme

Materials. The mat is a grid of two rows of 14 cells (Figure 1). Seventeen green cells carry the numbers 0 to 16 and mark foot placements; the remaining cells are yellow and unnumbered and provide space where particular movements require it. Cell 0, coloured purple, is the start and finish position and the reset point when learners lose orientation. The numbers are not arranged in numerical order along the mat; each marks where a foot lands at a given point in the routine. Separate route lines show the path of the left foot (blue) and the right foot (red), with arrows for the direction of travel and a mark for steps in which the foot is lifted, as in the kicks. The mat is non-slip and secured at the corners. Three cell sizes were produced: 30 × 30 cm for learners shorter than 170 cm, 35 × 35 cm for learners from 170 to 180 cm, and 40 × 40 cm for learners taller than 180 cm. Because the arrangement of cells is identical, the overall mat measures 4.2 × 0.6 m, 4.9 × 0.7 m or 5.6 × 0.8 m, while the numbering and the movement-to-cell coding are unchanged. Supporting materials comprise cue scripts, a standardised session plan, session and instructor checklists, attendance and home-practice logs, and a printable mat for home practice.

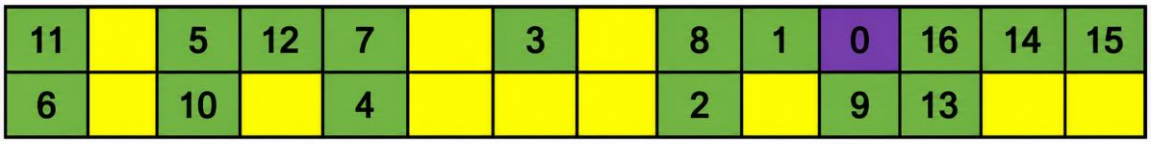


Figure 1 Layout of the Tai-C Matte Steps Floor Mat

Note. Green cells numbered 0 to 16 are foot-placement references; yellow cells are unnumbered; cell 0 (purple) is the start, finish and reset position. The same layout is used with 30, 35 and 40 cm cells.

Content and procedure. The 24 movements, their order and their technical requirements follow the standard routine (General Administration of Sport of China, 1999); the mat organises only where each foot is placed. The routine starts with both feet on cell 0, after which the feet open to cells 0 and 1; Part the Wild Horse's Mane then travels across cells 2 and 3, Cloud Hands moves between cells 0 and 8, the heel kicks are performed from cells 10 and 11, and the last four movements finish between cells 16 and 1 before the learner returns to cell 0 (Table 2). The numbers are reference points, not stopping points: learners are taught to move continuously through curved movements, transferring weight and turning from the waist rather than stepping mechanically from number to number. Across the 8 weeks, learning progresses from recognising the numbered cells to basic stepping, decomposition of each movement, coordination of the upper and lower limbs, integration into the full routine, and finally performance of the routine without the mat.

Table 2
Mat Cells Used for Each Movement of the 24-Form Routine

No.	Movement	Cells	No.	Movement	Cells
1	Commencing form	0; 0 and 1	13	Kick with right heel	10
2	Part the wild horse's mane	2, 3	14	Strike ears with both fists	10, 11
3	White crane spreads its wings	3, 4	15	Turn and kick with left heel	11
4	Brush knee and twist step	3	16	Push down and stand on one leg (left)	11, 12
5	Playing the pipa	5, 6	17	Push down and stand on one leg (right)	3, 12
6	Repulse monkey	5, 6	18	Shuttle back and forth	3, 8
7	Grasp the bird's tail (left)	0, 2	19	Needle at sea bottom	13, 14
8	Grasp the bird's tail (right)	8, 9	20	Fan through back	13, 15
9	Single whip	0, 2	21	Turn, deflect, parry and punch	1, 16
10	Cloud hands	0, 8	22	Apparent close	1, 16
11	Single whip	7, 10	23	Cross hands	1, 16
12	High pat on horse	7, 10	24	Closing form	0

Note. Cells are those labelled on the movement illustrations in the programme manual and show the end positions of the feet.

Each 60-minute lesson follows four stages: activation (arrival and readiness checks, breath centring and joint mobility), skill learning and practice (two or three short mat pathways

taught with demonstration, verbal and numbered cues and immediate feedback), integrated application (linking pathways into longer sequences, reduced-cue runs and brief balance practice) and conclusion and reflection (down-regulation breathing, review of key points and a technical focus for home practice). The weekly content is summarised in Table 3.

Table 3
Eight-Week Progression of the Tai-C Matte Steps

Week	Movements introduced or consolidated	Session objective	Check and home task
1	Commencing form; Wild Horse's Mane; White Crane Spreads Wings	Read the mat; stance width, neutral posture, basic weight shift	2-s stable hold at each position; breathing and stepping practice
2	Wild Horse completed; Brush Knee; Playing the Pipa; Repulse Monkey	Smooth weight transfer; arm timing matched to foot placement	Note balance loss during weight transfer; two short pathways
3	Grasp the Bird's Tail (left, right); first Single Whip; Cloud Hands begun	Link early segments; guided then partial-recall runs	Self-rated recall without number cues
4	Cloud Hands; second Single Whip; High Pat on Horse; Right Heel Kick	Stabilise before lifting; controlled return to stance	Balance holds; kick set-up and landing
5	Strike Ears with Fists; Left Heel Kick; reorientation using cell 0	Complex transitions; quick recovery from errors	Video feedback on transitions; reset and relink drills
6	Push Down and Stand on One Leg (left, right)	Safe depth; knee alignment; longer single-leg holds	3 × 20 to 30 s holds; note on perceived stability
7	Shuttle Back and Forth; Needle at Sea Bottom; Fan Through Back; Deflect, Parry and Punch	Full sequence with minimal cueing; breath timing	Instructor completeness checklist
8	Apparent Close; Cross Hands; Closing form; refinement	Rhythm, continuity and individual corrections from video; performance off the mat	2 to 3 full runs per session; ongoing practice plan

Note. Each week comprised three supervised 60-minute lessons and three 30-minute home-practice sessions. Cells for each movement are given in Table 2.

The Lessons were delivered face to face to one class of 15 learners in an indoor practice hall at Hefei College of Finance and Economics, Hefei, Anhui, China, during the students' existing class timetable. They were taught by a qualified Tai Chi instructor who was not the programme developer; the same instructor taught the conventional comparison class in the companion study and was aware of which condition was being delivered. Before implementation, the developer trained the instructor in the procedures, progression, cueing, safety requirements and fidelity procedures, and supervised implementation without teaching. Three supervised 60-minute lessons per week for 8 weeks (24 lessons, 1,440 minutes), plus three 30-minute home-practice sessions per week (24 sessions, 720 minutes) recorded by participants in home-practice logs. Cell size was matched to body height, step length and stance depth were reduced for any learner reporting discomfort, and end-range

knee flexion was avoided in low postures; the movement content was not changed. Readiness checks at the start of each lesson recorded sleep quality, soreness and new symptoms, learners could stop or modify practice at any time, and any adverse event identified during the intervention was to be entered in a safety record.

Fidelity was documented descriptively against the five domains of the Behavior Change Consortium framework (Borrelli, 2011). For design, the dose was fixed at 24 supervised lessons with a standard session plan. For training, the instructor was trained by the developer before implementation. For delivery, session checklists recorded attendance, session ratings of perceived exertion and the pathways delivered, instructor checklists recorded sequence completion and corrections, and selected lessons in weeks 4 and 8 were video recorded to check adherence to the plan. For receipt, the instructor checklists recorded whether learners completed each sequence. For enactment, home practice was recorded in self-report logs. No quantitative fidelity score was calculated, and the video recordings were not coded against a fidelity checklist.

Expert Content Validation

Five content experts were recruited purposively: two associate professors in sports science specialising in Tai Chi and three physical education lecturers, with 12 to 20 years of professional experience (Table 4). All five worked at the host institution, and none supervised the doctoral project. A separate specialist in foreign and applied linguistics reviewed the translation and linguistic clarity of the study materials and did not contribute to the content validity indices. Five experts lies within the range of three to ten recommended for content validation (Lynn, 1986).

Each expert independently rated 12 programme components (core principles, learning objectives, three teaching modules covering fundamental posture and footwork, progressive coordination training and integrated 24-form practice and transfer, session duration, exercise intensity, teaching instructions, safety procedures, equipment and layout, assessment method and overall programme structure) against four criteria: appropriateness, clarity, safety and feasibility. Ratings used a 4-point scale (4 = highly relevant, 3 = relevant with minor revision, 2 = major revision needed, 1 = not relevant). Experts also described strengths, weaknesses and recommended changes, and gave an overall recommendation on a 4-point scale from strongly recommend to not recommend. The experts rated the completed programme rather than a pool of candidate components, so the procedure tested acceptance of the design rather than selection of its content. The bilingual (Chinese and English) forms were completed in a single round, and the programme was revised in response to the comments without re-rating.

Statistical Analysis

Ratings of 3 or 4 were coded as agreement. The item-level content validity index (I-CVI) was the proportion of experts in agreement for each component and criterion, giving 48 criterion-level units. Scale-level validity was summarised as the mean I-CVI (S-CVI/Ave) and the proportion of units with universal agreement (S-CVI/UA), and both are reported, as recommended (Polit & Beck, 2006; Zamanzadeh et al., 2015). With only five experts, universal agreement is easy to reach, so S-CVI/UA adds little information here. Because I-CVI does not

adjust for chance agreement, a modified kappa was calculated for each unit (Polit et al., 2007) as:

$$k^{*} = (\text{I-CVI} - P_c) / (1 - P_c) \qquad (1)$$

with

$$P_c = \{N! / (A!\,(N - A)!)\} \times 0.5^{N} \qquad (2)$$

where N is the number of experts and A the number in agreement. With five experts, an I-CVI of 1.00 was required for acceptability (Lynn, 1986), an S-CVI/Ave of at least .90 was taken as excellent (Polit & Beck, 2006), and k^{*} above .74 as excellent (Polit et al., 2007). Because dichotomised indices cannot distinguish between ratings of 3 and 4, mean ratings and the number of ratings of 3 were also reported for each component and criterion. Written comments were translated into English, grouped by theme and logged with the revision made. Indices were calculated from the original rating forms.

Feasibility was described as retention, attendance at supervised lessons, completion of prescribed home practice, fidelity records and adverse events (Bowen et al., 2009). No feasibility or progression criteria were specified before implementation, so these results are reported descriptively rather than judged against thresholds (Thabane et al., 2010).

Results

Expert Panel

The five content experts had a mean of 16.8 years of professional experience (SD = 2.9; range 12 to 20), and four held a master's degree (Table 4). All five were based at the host institution; the language specialist was based at another university.

Table 4

Characteristics of the Expert Panel

Expert	Role	Field	Academic rank	Highest qualification	Experience (years)
E1	Content	Sports science (Tai Chi)	Associate professor	Master's	18
E2	Content	Sports science (Tai Chi)	Associate professor	Master's	20
E3	Content	Physical education	Lecturer	Master's	17
E4	Content	Physical education	Lecturer	Master's	17
E5	Content	Physical education	Lecturer	Bachelor's	12
L1	Language review only	Foreign and applied linguistics	Assistant professor	Ph.D	18

Note. E1 to E5 rated the programme and contributed to the content validity indices; L1 reviewed translation and language only. E1 to E5 were employed at the host institution and L1 at a university in Shanghai.

Content Validity

Of the 240 ratings, 234 (97.5%) were 4 and six were 3; no component received a rating below 3. All 48 criterion-level units therefore reached an I-CVI of 1.00 and a modified kappa of 1.00, and both S-CVI/Ave and S-CVI/UA were 1.00 (Table 5). The mean rating was 3.98. By criterion, mean ratings were 4.00 for feasibility, 3.98 for clarity and safety, and 3.93 for appropriateness, which accounted for four of the six ratings of 3. Equipment and Layout received the lowest component mean (3.85), with one rating of 3 each for appropriateness,

clarity and safety; Learning Objectives, Integrated 24-Form Practice and Transfer, and Session Duration each received one rating of 3 for appropriateness. All five experts gave an overall recommendation of strongly recommend.

Table 5
Content Validity of the 12 Programme Components (5 Experts × 4 Criteria)

Programme component	Mean rating	Ratings of 4 (of 20)	Ratings of 3	I-CVI (4 criteria)	k* (4 criteria)
Core principles	4.00	20	0	1.00	1.00
Learning objectives	3.95	19	1 (A)	1.00	1.00
Module 1: Fundamental posture and footwork	4.00	20	0	1.00	1.00
Module 2: Progressive coordination training	4.00	20	0	1.00	1.00
Module 3: Integrated 24-form practice and transfer	3.95	19	1 (A)	1.00	1.00
Session duration	3.95	19	1 (A)	1.00	1.00
Exercise intensity	4.00	20	0	1.00	1.00
Teaching instructions	4.00	20	0	1.00	1.00
Safety procedures	4.00	20	0	1.00	1.00
Equipment and layout	3.85	17	3 (A, C, S)	1.00	1.00
Assessment method	4.00	20	0	1.00	1.00
Overall programme structure	4.00	20	0	1.00	1.00
All components	3.98	234 (of 240)	6	1.00	1.00

Note. Each component was rated by five experts on appropriateness (A), clarity (C), safety (S) and feasibility; letters show the criterion that received a rating of 3. I-CVI = item-level content validity index (ratings of 3 or 4 counted as agreement); k* = modified kappa; S-CVI/Ave = mean I-CVI across the 48 units = 1.00; S-CVI/UA = proportion of units with universal agreement = 1.00.

Revisions After Expert Review

Three experts provided written comments, which led to four refinements before implementation (Table 6). The largest change was the introduction of three cell sizes so that step length matched the learner's stride. The others clarified that the numbers act as reference points within continuous movement, separated the learning objectives into a progression ending in performance without the mat, and aligned the assessment criteria with the technical requirements of the routine. The 24 movements and their order were not changed.

Table 6
Expert Comments and Resulting Revisions

Expert	Comment (translated and paraphrased)	Revision made
E1	Lesson structure is clear, with four theory-based stages (activation, skill practice, integrated application, reflection). Mat spacing should be adjusted slightly to the learner's natural stride.	Four-stage lesson retained; three cell sizes (30, 35 and 40 cm) introduced and allocated by body height.
E2	The programme follows the official 24-form technical standard, and the numbered mat addresses novices' difficulty with foot orientation. In curved movements the cells are only reference points; learners should not pause rigidly on a number, and movement should be led by the waist.	Cue scripts and instruction revised so that numbers are temporary references within continuous, waist-led movement.
E3	Minor improvement needed in the flexibility of the mat layout, the layering of learning objectives and the detail of movement assessment.	Learning progression stated as footwork, coordinated movement, integrated 24-form practice and performance off the mat; assessment criteria aligned with the technical requirements of the routine.
E4, E5	No written comments.	None.

Note. Comments were written in Chinese on the validation forms and translated by the authors.

Implementation Feasibility

Fifteen physically inactive students (8 men, 7 women; mean age 18.80 years, SD = 0.86) received the programme. Under the height rule, nine used the 30 cm cells, five the 35 cm cells and one the 40 cm cells. All 15 completed the 8 weeks and the posttest assessments, and none withdrew. They attended 353 of 360 scheduled participant-lessons (98.1%) and recorded completion of 353 of 360 prescribed home-practice sessions (98.1%). For context, the conventionally taught comparison class in the companion study attended 349 of 360 lessons (96.9%), so high attendance was not specific to the mat. Session and instructor checklists were completed for the programme, and selected lessons in weeks 4 and 8 were video recorded; these records were used descriptively and no fidelity score was calculated. No adverse events were recorded in the readiness checks or the safety record.

Discussion

This study describes a Tai Chi teaching programme that keeps the full 24-form routine and aims to reduce the spatial demands of learning it. Five experts from the host institution rated every component as relevant on all four criteria, their comments led to four targeted refinements, and in one class the programme was delivered with complete retention, high attendance and no recorded adverse events. Because the programme is specified against TIDieR, it can be replicated and tested. These results establish that the programme is fully described, acceptable to experienced local staff and deliverable in a college setting. They do not establish that it improves learning.

Most adaptations of Tai Chi make practice possible by changing the content, through shorter routines, selected movements or added therapeutic exercises (Chen et al., 2020; Li, 2014; Li

et al., 2018), or by drilling the footwork separately from the routine (Mao et al., 2024). These approaches suit older and clinical groups, but a learner who completes them has not learned the standard routine. The Tai-C Matte Steps takes a different approach. It leaves the 24 movements and their order unchanged and alters the learning conditions, moving the route out of working memory and onto the floor (Sweller, 1988). Whether this produces better learning than conventional teaching is an empirical question; the comparative evidence on routine length is itself mixed (Lei et al., 2022; Zou et al., 2019), and the case for keeping the full form in students rests mainly on the learning goal of physical education rather than on evidence of superior health effects.

Two parts of the programme theory need more caution than the original design assumed. First, the idea that an external target improves motor learning (Wulf, 2013) is contested: after correction for publication bias, the average benefit of an external focus was close to zero for performance and small for retention and transfer (McKay et al., 2024). A network meta-analysis of sport skills found an external focus most useful at the end of acquisition and a holistic focus, on the movement as a whole, most useful for retention and transfer (Favre-Bulle et al., 2024). This pattern is consistent with the expert comment that the numbers should act as reference points within continuous, waist-led movement rather than as places to stop, and it supports the decision to withdraw the mat progressively. Second, when foot placement matters, people look at their targets, and longer gaze on the targets reduces placement error (Domínguez-Zamora et al., 2018). A floor mat will therefore tend to draw the eyes and head downward, against the upright head position that Tai Chi requires. Guidance that is always present can also improve performance during practice while weakening it once removed (Salmoni et al., 1984). The programme addresses both risks by withdrawing cues in stages and ending with performance off the mat, and in the companion study Tai Chi performance was assessed off the mat. Whether learners keep an upright gaze and move continuously while on the mat has not been measured and could be checked with video analysis of practice.

The expert feedback sharpened the central design question. Half of the six ratings below the maximum concerned the mat itself, and all three written comments mentioned it: its layout and step spacing, and the risk that numbers would turn flowing movement into a series of stops. Both concerns follow from the scaffold, not from the Tai Chi content. Matching cell size to body height addresses the first, and instructing learners to treat numbers as references within continuous movement addresses the second.

The content validity results need careful reading. Agreement was universal, but 97.5% of ratings were at the scale maximum, which leaves little variance, so the dichotomised indices carry less information than the pattern of ratings of 3 and the written comments (Polit & Beck, 2006). The same ceiling was reported in the only Tai Chi protocol we found that had been content-validated, where six experts gave every item an I-CVI of 1.00 in a single round (Yao et al., 2021). A more discriminating design is illustrated by the development of a training module for Chinese college students, in which teachers and experts screened candidate movements over two Delphi rounds and excluded most of them (Cui et al., 2026). In the present study the experts rated a finished programme, all five worked at the host institution, and there was one round with no re-rating after revision. The indices therefore show that experienced Tai Chi and physical education staff accepted the programme as appropriate, clear, safe and feasible.

They do not show that the panel selected or tested its content, and content validity is in any case a judgement about relevance, not evidence of effect (Polit & Beck, 2006).

The feasibility results are also best read descriptively. Attendance of 98.1% compares favourably with the 90% reported for on-site teaching of the 24-form in a recent trial with college students (Xu et al., 2026), but the lessons took place during the students' class timetable, and the conventionally taught comparison class attended almost as often (96.9%). High attendance is therefore more likely to reflect the scheduled class setting than the mat. No feasibility criteria were set in advance, which reporting guidance for pilot and feasibility studies recommends (Eldridge et al., 2016; Thabane et al., 2010). For the next study, we propose explicit progression criteria covering recruitment, retention, adherence and data completeness (Avery et al., 2017), for example retention of at least 85%, attendance of at least 80%, complete outcome data for at least 90% of participants and delivery of at least 80% of planned session content on fidelity checklists. No adverse events were recorded. Tai Chi is unlikely to cause serious adverse events, but minor musculoskeletal aches are the expected type, and adverse-event monitoring is poorly reported in Tai Chi trials (Wayne et al., 2014); our monitoring relied on readiness checks and a safety record rather than a structured symptom questionnaire, so minor complaints may have been missed. Home-practice completion was self-reported in logs whose validity is unknown, a common problem with exercise-adherence measures (McLean et al., 2017). Fidelity was documented across the five domains of the Behavior Change Consortium framework, but only descriptively (Borrelli, 2011).

Several further limitations constrain interpretation. The expert panel was small, came from one institution and rated the programme once. Learners were not involved in designing the mat, and no qualitative learner data were collected, so co-design and think-aloud testing would strengthen a later version. Implementation data came from one class of 15 students at one college, taught by one instructor who knew which condition was being delivered, under the supervision of the developer. The weekly plan in the original protocol listed cell ranges that differ from the movement illustrations; the illustrations were used here, and a single verified route map should be published with the programme. Finally, the claim that no comparable programme exists rests on searches of English-language databases and Chinese-language web sources; footprint charts are a familiar informal aid in physical education, and an unpublished or Chinese-language equivalent may exist.

The practical implication is that the mat offers a low-cost, technology-free way to teach the standard routine. It can be laid out in a classroom or gymnasium, its three cell sizes accommodate learners of different heights, and teachers who already teach the 24-form can adopt it without learning a new routine, because only the delivery changes. For evaluation, one consequence of the evidence base should be noted. Because the comparison condition in the companion study also taught Tai Chi, and traditional Chinese mind-body practice has shown little advantage over active comparison conditions for anxiety in university students (Liu et al., 2026), the main test of the mat lies in learning and performance outcomes rather than in psychological outcomes. The mat layout, route map, lesson plans, cue scripts and fidelity checklists are provided as supplementary material to support replication.

Conclusion

The Tai-C Matte Steps is a fully described, theory-informed programme that maps the footwork of the standard 24-form Taijiquan onto a numbered floor mat with three cell sizes. Five experts from the host institution judged all 12 components appropriate, clear, safe and feasible, although the ceiling in their ratings limits what the indices can show, and their comments led to stride-matched cells and clearer guidance on continuous movement. In one class of physically inactive college students, the programme was delivered over 8 weeks with full retention, 98.1% attendance and no recorded adverse events. Future work should set feasibility criteria in advance, use an external panel with more than one round, involve learners in refining the mat and test whether the mat improves learning of the standard routine compared with conventional instruction.

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Conflict of interest

The Tai-C Matte Steps was designed by the first author and the authors declare no conflicts of interest.

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Data availability

The rating forms, implementation records and programme materials are available from the corresponding author on reasonable request.

AI-assisted editing

Generative AI tools (Claude by Anthropic, Model 5.5 Opus) were used for language refinement and structural editing under the authors' supervision. The authors reviewed every source and revision, verified all data against the original records and accept responsibility for the final manuscript.

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