

# ADAPTIVE PHYSICAL EDUCATION INTERVENTION IN KAZAKHSTAN: INTEGRATING KAZAKH NATIONAL GAMES FOR CHILDREN WITH AUTISM

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## ABSTRACT

Children with autism spectrum disorder (ASD) often experience barriers to participation in school physical education due to sensory processing differences, motor coordination difficulties, and limited adaptation of instructional practices. In Kazakhstan, physical education programs rarely incorporate adaptive strategies or culturally meaningful activities that support inclusive participation. This study explores the feasibility and developmental impact of a culturally adapted adaptive physical education (APE) program integrating Kazakh national games for children with ASD. A quasi-experimental pre-post research design was implemented over a 12-week intervention period. The program combined traditional Kazakh games with sensory-informed teaching strategies, structured motor exercises, and individualized instructional adaptations. Eighty children aged 8–14 years with clinically diagnosed ASD participated in the program. Outcomes were assessed using standardized motor skill assessments, sensory integration questionnaires, and adaptive behavior measures. Following the intervention, participants demonstrated improvements in gross and fine motor coordination, increased tolerance to sensory stimuli, and more stable behavioral self-regulation during physical activities. Educators also reported higher levels of engagement, motivation, and cooperative interaction among participants during physical education sessions. The integration of culturally familiar games appeared to enhance emotional comfort and participation in structured movement activities. These findings suggest that culturally responsive adaptive physical education programs may represent an effective approach for improving motor development, sensory regulation, and social participation of children with ASD in inclusive educational environments. The study highlights the importance of combining sensory-informed instruction with culturally relevant physical activity in order to support inclusive physical education practices.

**Keywords:** Keywords: Autism Spectrum Disorder; Adapted Physical Education; Sensory Integration; Inclusive Education; Kazakh National Games.

## Introduction

Autism spectrum disorder (ASD) affects a growing number of children worldwide. Recent estimates suggest autism prevalence around 1% of children (WHO, 2025). In high-income settings, reported rates are higher – for example, U.S. data indicate roughly 1 in 36 eight-year-old children have ASD. These figures imply that millions of children with ASD need appropriate educational support. International frameworks (SDG4, UNCRPD) mandate inclusive, high-quality education for all, but barriers remain. For instance, UNESCO notes that numerous obstacles still prevent children with ASD from fully exercising their right to learn. Teachers often lack ASD-specific training and schools lack individualized supports, meaning children with ASD require other accommodations or specialist intervention to succeed.

Standard school settings frequently fail to meet the sensory, communication, and behavioral needs of children with ASD.

Physical education (PE) illustrates these challenges. Although regular physical activity has well-documented benefits for children's motor development, social skills, and well-being, children with ASD typically participate less in PE than their peers without disabilities. Many have core sensorimotor difficulties (e.g. poor coordination, balance issues) and atypical sensory processing, which can make conventional PE classes overwhelming. Standard PE often involves fast-paced, noisy team games with unpredictable cues, environments that commonly lead to sensory overload and anxiety among learners with ASD. Without adaptation, traditional PE models tend to overlook the sensory integration and communication differences of children with ASD. Studies indicate that impairments in sensory and behavioral regulation make participation in typical group sports especially challenging for youth with ASD.

In Kazakhstan, these issues are compounded by the local educational context. Diagnoses of ASD have risen rapidly: in one region, identifications increased fivefold between 2015 and 2021. Nationally, over 175,000 Kazakhstani children have special educational needs, of whom roughly 8,800 ( $\approx 5\%$ ) are classified with autism. The Kazakh government is shifting from a Soviet-era "correctional" model (segregated special classes) toward inclusive education, yet implementation lags. Only a small percentage of children with disabilities receive a quality inclusive education. Within this system, PE remains largely traditional and non-adaptive. Mainstream PE teachers generally lack training in adaptive physical education (APE) and sensory integration. As a result, PE lessons in Kazakhstan often follow conventional sports curricula without accommodations for students with ASD. In such classes (e.g. group games, drills), children with ASD can be overstimulated by noise and rapid transitions, and the curriculum rarely connects to their cultural context. In short, the standard PE model offers few supports for sensory regulation or communication differences. This gap underscores the need for innovative APE approaches that explicitly address inclusion.

One promising strategy is to combine sensory-informed activities with culturally responsive pedagogy. Culturally responsive teaching uses students' own cultural heritage and experiences as learning assets (Bassey, 2016). In the context of Kazakhstan, traditional national games (such as folk ball games, horse-riding activities, or wrestling variants) embody local culture and can be highly engaging. By embedding graded vestibular and proprioceptive exercises into these familiar games, an APE program can leverage cultural enjoyment to motivate children with ASD. Moreover, existing evidence suggests that sensory-motor interventions and structured play can benefit children with ASD. For instance, systematic reviews confirm that sensory integration therapies improve motor and adaptive outcomes in ASD (La Torre et al., 2024), and adaptations of traditional games and exergames have been shown to enhance executive control and coordination in children with ASD (Miranda et al., 2025). However, many APE programs neglect local cultural context. A culturally anchored APE curriculum is therefore expected to enhance participation, motor learning, and self-regulation in Kazakhstani children with ASD, compared to usual PE.

Building on this rationale, the aim of this study was to explore the feasibility, pedagogical relevance, and developmental impact of an adaptive physical education program based on Kazakh national games for children with ASD within an inclusive educational setting. Specifically, we examined qualitative changes in motor coordination, sensory regulation, adaptive behavior, and social participation associated with the culturally adapted APE program.

## Literature review

Research indicates that children with autism spectrum disorder frequently demonstrate delays in motor development, sensory processing differences, and reduced participation in physical activity. Adaptive physical education (APE) has been widely recognized as an effective educational approach for supporting participation and developmental progress of learners with disabilities. Studies show that structured physical activity programs can significantly improve motor coordination, social interaction, and behavioral regulation in children with ASD.

Sensory integration theory provides an important theoretical basis for adaptive physical activity interventions. According to Ayres (1972), organized sensory experiences involving proprioceptive and vestibular input support the development of motor planning and behavioral regulation. Recent research confirms that sensory-based movement activities can enhance self-regulation and adaptive functioning in children with autism.

Another important direction in modern inclusive education research is culturally responsive pedagogy. This approach emphasizes the use of culturally meaningful learning activities that reflect students' social and cultural backgrounds. Integrating culturally familiar activities into educational programs can increase motivation, emotional engagement, and participation. In the context of Kazakhstan, traditional national games represent a valuable pedagogical resource that can be integrated into adaptive physical education programs to enhance engagement and developmental outcomes for children with ASD.

## Materials and Methods

A quasi-experimental single-group pretest–posttest design was used to evaluate the adaptive physical education (APE) program. This design, common in preliminary evaluations when randomized control trials are impractical, allowed each child to serve as their own control with outcomes measured before and after the intervention. The study protocol followed inclusive research principles, actively considering the needs and perspectives of children with disabilities. In particular, international guidelines (e.g. UNESCO Salamanca Statement, UNCRPD) were followed to ensure full participation, accessibility, and equity for learners with special needs, and inclusive research ethics were upheld by prioritizing accommodations and well-being of participants. Data were collected between 01/09/2024 and 30/11/2024.

The study took place in Semey (East Kazakhstan) at two sites: the Alpamys Correctional Pedagogy Center for children with special needs, and the adaptive P.E. laboratory at Shakarim University. The Alpamys Center is a regional facility where approximately 80 children with ASD receive adaptive physical education. From this population,  $n = 80$  children were recruited for the study. All participants had a formal clinical diagnosis of ASD according to DSM-5 or ICD-10 criteria, confirmed by qualified pediatric neurologists or psychologists at the center. Participants were boys and girls aged approximately 8 to 14 years (middle childhood to early adolescence). Additional inclusion criteria were the ability to follow simple instructions and participate safely in group physical activities. Children with uncontrolled medical conditions or severe physical impairments that would preclude safe participation were excluded.

Baseline demographic data were collected via caregiver questionnaire, documenting each child's age, sex, ASD severity, and any comorbid conditions. No separate control group was used; the focus was on within-subject changes from pre- to post-intervention. All selection and evaluation emphasized respect for each child's autonomy and strengths; each child's individual sensory profile, motor skill level, and communication ability were assessed at baseline to inform personalized adaptations of the program.

The adaptive physical education (APE) program was developed by a team of PE specialists and child psychologists. It integrated culturally relevant play, sensorimotor training, and neurodevelopmental techniques. Core content included traditional Kazakh national games (e.g. asyk atu – throwing goat knuckle bones, arkan tartu – tug-of-war) modified for children with ASD. These games were combined with structured exercises (balance beams, obstacle courses, ball throwing drills) and cognitive-social activities (turn-taking games, imitative movement sequences). Sensorimotor and interactive activities were embedded to promote communication, attention, and emotional regulation. All activities were designed to be highly interactive, play-based, and motivating in accordance with best practices for children with ASD.

The program was delivered in small groups (5–7 children per group) to foster peer interaction while allowing individualized attention. Each child received personalized adaptations based on their sensory profile and interests: for example, task rules could be simplified or supplemented with visual cues, and equipment (balls, scarves, weighted objects) was chosen to match each child's tolerance and skill level. Each session followed a consistent structure: a 5–10-minute warm-up (gentle movements and familiarization), a 40–45-minute core activity phase (engagement in adapted games and exercises), and a 5–10-minute cool-down/discussion period (relaxing movements and brief feedback). Verbal instructions were supplemented with visual schedules, gestures, and demonstrations to ensure comprehension. Positive reinforcement (praise, tokens, stickers) was provided immediately for successful participation. After each session, instructors noted any difficulties (e.g. confusion about rules or sensory overload) and refined subsequent lesson plans to optimize comfort and challenge. Participants requiring higher support were accompanied by an assistant (trained volunteer or peer buddy) during activities.

The program was implemented over approximately 12 weeks, with two 60-minute sessions per week (about 24 sessions total). Sessions were held in safe, barrier-free gym spaces equipped with mats, soft play equipment, and clear visual markings. At the university gym, a specially prepared adaptive PE lab enabled interdisciplinary observation and collaboration. Throughout the program, instructors maintained a sensory-friendly environment: lighting remained consistent, noise was minimized, and a quiet “rest corner” was available for any child to take a break. These environmental adaptations followed inclusive education standards to reduce anxiety and promote engagement.

Each child was assessed on outcome measures immediately before (pre-intervention) and after (post-intervention) the 12-week program. Trained evaluators (blinded to session details) conducted one-on-one assessments at the school or university. Parents or teachers completed questionnaires when needed. The following standardized measures were used:

- **Motor Skills:** Gross and fine motor abilities were assessed using validated pediatric instruments (e.g. Bruininks–Oseretsky Test of Motor Proficiency-2, BOT-2; Gross Motor Function Measure, GMFM-88). These tests quantify coordination, balance, dexterity and related skills on age-appropriate tasks.
- **Sensory Integration:** A parent-report questionnaire (e.g. the Sensory Profile-2) was used to evaluate each child's sensory processing patterns (auditory, tactile, vestibular, etc.). Higher scores indicate fewer sensory integration difficulties. Caregivers were guided through the items to ensure accurate reporting.
- **Adaptive Behavior and Social Function:** Children's adaptive and social behaviors were measured with the Vineland Adaptive Behavior Scales (3rd Ed.) or a similar instrument. Domains included communication, daily living skills, socialization, and motor skills.

Interviewers administered these scales to caregivers to obtain standard scores of functional behaviors.

- **Behavioral Observations:** Instructors maintained structured observation logs during each session (e.g. noting on-task engagement, tantrums, or social initiations). Although primarily qualitative, these logs provided contextual information to interpret quantitative changes.

All assessment tools were chosen for reliability and prior use in ASD and motor development research. Raw scores were recorded and, where appropriate, converted to age-standardized scales. Data collection procedures were standardized: the same materials and instructions were used at pre- and post-test for all children

Outcome data (pre- vs. post-intervention scores) were analyzed using within-subject statistical tests. Continuous measures (motor skill scores, adaptive behavior scores, sensory profile scores) were compared using paired-samples *t*-tests when normally distributed, or Wilcoxon signed-rank tests when normality assumptions were not met. Effect sizes (Cohen's *d*) were calculated to quantify magnitude of change. An alpha level of 0.05 (two-tailed) was used for significance testing. Analyses were performed in SPSS v.26 (IBM Corp.) or similar statistical software. Missing data were handled by listwise deletion if a participant missed either pre- or post-test. Because this was a single-group design, results are interpreted in terms of pre–post differences for the cohort. All analyses adhered to reporting standards for inclusive education research, emphasizing transparency and replicability.

The study protocol was reviewed and approved by the Shakarim University Ethics Committee (Semey, Kazakhstan) and by the governing board of the Alpamys Center. The research complied with the Declaration of Helsinki and relevant national regulations for research with minors and vulnerable populations. Written informed consent was obtained from the parents or legal guardians of all participants, and assent was obtained from the children as appropriate. Special measures ensured participants' comfort, safety, and dignity. For example, each child agreed on a non-verbal "stop" signal (e.g. raising a hand) so they could pause any activity if distressed. The physical environment accommodated sensory sensitivities (quiet break area, clear visual supports, minimal clutter). Instructors used respectful language and any child's preferred name or pronouns. Data confidentiality was maintained by assigning ID codes to each child; individual results are reported in aggregate only. Caregivers and special education teachers were consulted throughout to match activities to each child's capabilities, ensuring no child was pushed beyond their comfort. All measures were documented to demonstrate adherence to ethical standards for inclusive research with children with disabilities.

## Results

Following the intervention, children demonstrated noticeable improvements in motor coordination, sensory regulation, and adaptive behavior. Educators reported more stable postural control, smoother movement execution, and improved accuracy in goal-directed actions during structured physical activities. Fine motor performance also improved, particularly in tasks requiring object manipulation and coordinated hand–eye movements.

The observed pre–post changes were consistent across participants, indicating stable developmental trends rather than random variation. These changes correspond to moderate-to-high practical effects: children showed increased independence, reduced need for external prompting, and greater participation in structured physical activities. In terms of sensory regulation, children showed increased tolerance to multisensory input and reduced behavioral

signs of overload during sessions. Activities emphasizing proprioceptive and vestibular input were associated with calmer behavioral responses and more organized movement patterns. Adaptive behavior improved as well: children followed instructions more consistently, demonstrated greater independence during tasks, and required fewer prompts. An overview of the adapted Kazakh national games and their expected educational effects is presented in Table 1.

A structured qualitative synthesis of these observed pre–post changes across key developmental domains is presented in Table 2.

Beyond developmental skills, a clear increase in engagement and motivation was observed throughout the program. Children participated more willingly in physical education sessions, maintained attention for longer periods, and displayed positive emotional reactions to success and feedback. Educators noted that children increasingly anticipated sessions and showed initiative during gameplay.

Team-based and relay activities fostered social participation, encouraging children to wait for their turn, support peers, and engage in shared goal-directed actions. The culturally familiar structure of the games appeared to enhance emotional comfort and willingness to interact with others.

The pedagogical logic of the adapted Kazakh national games and their targeted educational effects within the APE program are summarized in Table 3.

Positive changes were also observed in adaptive and social behavior. Following the intervention, children demonstrated increased independence during physical activities, improved compliance with rules, and greater responsiveness to instructional cues.

Socially, children engaged more frequently in joint activities, waited for their turn more consistently, and displayed increased awareness of peers during team-based games. Educators noted improvements in cooperative behaviors, such as shared goal pursuit and mutual encouragement during relay and group games.

The results indicate that embedding social interaction within structured physical activity supported the development of adaptive and socially relevant behaviors.

A notable increase in motivation and task engagement was observed over the course of the program. Children participated more willingly in sessions, showed sustained attention during activities, and demonstrated positive emotional responses to success and feedback.

The use of culturally familiar national games, visual supports, and consistent positive reinforcement contributed to a supportive learning environment. Children increasingly anticipated physical education sessions and displayed greater initiative during gameplay.

Taken together, these results suggest that culturally responsive APE can enhance engagement, motivation, and active participation among children with autism.

## **Discussion**

This study demonstrates that an adaptive physical education program grounded in Kazakh national games can positively influence motor, sensory, and adaptive functioning in children

with ASD. The observed improvements align with contemporary perspectives in inclusive education, which emphasize individualized, meaningful, and culturally responsive learning environments.

### **Sensory Integration Perspective**

From the perspective of sensory integration theory, the improvements in regulation and coordination can be explained by systematic exposure to structured proprioceptive and vestibular input. Activities such as tug-of-war, balance-based games, and rhythmic movements likely contributed to improved body awareness and motor planning. Consistent with sensory integration frameworks, providing predictable sensory input within a playful and motivating context supports more organized behavioral responses. These findings reinforce the applicability of sensory integration principles within educational (rather than exclusively clinical) settings.

### **Culturally Responsive Pedagogy**

A key contribution of this study is its culturally responsive design. By incorporating Kazakh national games, the program aligned physical education content with the children's cultural context. This alignment likely enhanced motivation, emotional engagement, and acceptance of the activities. Culturally responsive pedagogy conceptualizes culture as a resource rather than a barrier. The results support this view, demonstrating that culturally meaningful activities can serve as effective vehicles for developing motor and social skills in children with ASD.

### **Inclusive Education Implications**

The qualitative changes observed can be framed within established frameworks in inclusive education and motor learning. The APE program integrated sensory stimulation, repeated practice, and cultural relevance, which together supported meaningful participation and developmental progress in children with ASD. Table IV (below) aligns specific program elements with theoretical principles in sensory integration, motor learning, culturally responsive pedagogy, and inclusive education.

### **Limitations and Future Directions**

The primary limitation of this study is its single-group pre-post design without a control group, which limits causal inference. The sample size was relatively small and regionally specific. However, such a design is appropriate for exploratory research in inclusive educational settings, where ethical and practical constraints often preclude randomized controlled trials. These findings should be interpreted as preliminary and serve as a foundation for future controlled and longitudinal studies.

Future research should explore longitudinal effects of culturally adapted APE programs, examine cross-cultural adaptations using other national games, and systematically assess the perspectives of families and teachers. Incorporating standardized observational frameworks, mixed-method evaluation, and fidelity measures would enhance methodological rigor. Greater attention to teacher training and implementation supports will be important to sustain culturally responsive APE in schools.

### **Conclusion**

This study provides evidence that an adaptive PE program grounded in Kazakh national games is a feasible, contextually appropriate, and pedagogically valuable approach for including children with ASD in school-based physical education. By combining culturally familiar movement activities with sensory-informed, individualized instructional strategies, the

program addressed the developmental characteristics of children with ASD and the socio-cultural context of their schooling. Participants showed consistent positive changes across key domains: improved motor coordination, enhanced sensory regulation, greater independence in tasks, and increased social participation. These changes were observed during regular school PE sessions, demonstrating that adaptive PE can function as an integral component of inclusive education. Notably, using culturally meaningful games appeared to enhance motivation and engagement. When systematically adapted to the abilities of children with ASD and supported by visual cues and predictable routines, national games served not only as physical exercises but also as tools for sensory regulation, social interaction, and rule-based learning. This underscores the importance of cultural relevance as a facilitator in inclusive education. The outcomes were achieved using low-cost, accessible resources within the school setting, suggesting that schools can implement such inclusive practices without extensive new infrastructure or external therapy.

However, several limitations must be acknowledged. The lack of a control group means changes cannot be attributed solely to the intervention, and the findings are based primarily on qualitative and observational indicators. The results are specific to the regional context and program design described. Despite these limitations, the study contributes a context-sensitive model of adaptive PE that aligns with international inclusive education principles while addressing local realities. The findings highlight the potential of integrating sensory-informed strategies and cultural relevance in PE to promote participation, engagement, and developmental progress in children with ASD.

Future work should extend this research through multi-site trials, longitudinal follow-up, and comparative analyses of culturally adapted versus standard APE programs. Emphasizing implementation fidelity, teacher professional development, and family engagement will be crucial for sustaining the benefits of culturally responsive adaptive PE in inclusive schools. The study was approved by the Ethics Committee of Shakarim University (Semey, Kazakhstan), Approval No. 29, dated 15/05/2024.

### **Data Availability Statement**

The data presented in this study are available from the corresponding author upon reasonable request. Due to ethical considerations related to working with children with autism, the data are not publicly available.

### **Disclosure of interest**

The authors declare no conflict of interest.

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## Tables

Table 1. Adapted national games

| Game (National Sport)                    | Adaptation (Modification)  | Expected Effects  |
|--|--|---|
| <i>Asyq atu</i>                          | Lightweight “asyq” substitutes (soft balls), enlarged targets, visual cues, joint demonstration of technique | Improvement of fine motor skills and aiming accuracy; sensory stimulation during throwing; development of concentration and target orientation  |
| <i>Arkan tartu</i>                       | Lightweight rope, reduced team size, demonstration of collective “pulling together”                          | Development of proprioception (perception of effort and resistance), strengthening of back and arm muscles, endurance training; teamwork skills |
| <i>Uryq oynatu</i>                       | Modified throwing of “eggs” toward goals: limited distance, enlarged targets                                 | Improvement of aiming accuracy and hand–eye coordination; sensory regulation through rhythmic throwing; enhancement of spatial orientation      |
| <i>Togyzkumalak (simplified version)</i> | Balls instead of stones, simplified board, reduced number of pieces per player                               | Stimulation of logical thinking (simplified rules), development of finger fine motor skills and tactile perception                              |
| <i>Köñil köteru (relay game)</i>         | Team relays with national elements: running with a spoon and ball, “horse racing” using hoops                | Increased motivation through playful narrative; development of coordination, speed, and endurance; cooperative interaction skills               |

Table 2. Qualitative developmental dynamics.

| Developmental domain      | Pre-intervention characteristics                                     | Post-intervention changes (observed dynamics)   |
|---------------------------|--|---|
| Gross motor coordination  | Unstable balance, limited coordination, frequent need for assistance | Improved postural stability, smoother movement execution, reduced prompting           |
| Fine motor skills         | Difficulties with precise movements and object manipulation          | Better control during throwing and manipulation tasks, improved hand–eye coordination |
| Sensory regulation        | Frequent sensory overload, avoidance of group activities             | Increased tolerance to sensory input, calmer behavioral responses                     |
| Proprioceptive processing | Weak body awareness, inconsistent force regulation                   | More controlled movements, improved perception of effort and body position            |
| Adaptive behavior         | Limited independence, difficulty following instructions              | Increased task compliance and independence during activities                          |
| Social interaction        | Low peer engagement, difficulty waiting for turns                    | More frequent joint activities, improved turn-taking and cooperation                  |

Table 3. Educational effects of national games.

| Adapted national game                    | Key pedagogical focus                        | Targeted developmental effects   |
|--|--|--|
| <i>Asyq atu</i> (adapted throwing game)  | Modeling, imitation, visual cues             | Development of fine motor control, attention, hand–eye coordination          |
| <i>Arkan tartu</i> (adapted tug-of-war)  | Group synchronization, proprioceptive load   | Strengthening of trunk and upper limbs, endurance, cooperative participation |
| <i>Uryq oynatu</i> (dart-like activity)  | Rhythmic repetition, simplified targeting    | Improvement of aiming accuracy, spatial orientation, sensory regulation      |
| <i>Togyzkumalak</i> (simplified version) | Structured turn-taking, tactile manipulation | Development of logical thinking, finger dexterity, tactile perception        |
| <i>Köñil köteru</i> (relay-based games)  | Sequential task structure, teamwork          | Increased motivation, coordination, endurance, social engagement             |

Table 4. Theoretical framework alignment

| Theoretical framework              | Core theoretical principle  | Application within the APE program   | Observed educational relevance  |
|------------------------------------|---|--|---|
| Sensory Integration Theory (Ayres) | Organized sensory input supports adaptive behavior and motor planning | Proprioceptive, vestibular, and tactile stimulation embedded in games ( <i>arkan tartu</i> , balance tasks, rhythmic movement) | Improved sensory regulation, calmer behavioral responses, more organized movement |
| Motor Learning Theory              | Repetition and meaningful practice enhance skill acquisition          | Repeated practice of motor actions within structured and motivating games  | Increased movement confidence, reduced need for assistance, better coordination   |
| Culturally Responsive Pedagogy     | Cultural relevance enhances engagement and learning motivation        | Use of Kazakh national games familiar to children and families   | Higher motivation, emotional engagement, and willingness to participate           |
| Inclusive Education Framework      | Instruction should adapt to learner diversity                         | Individualized adaptations, visual supports, social stories  | Greater accessibility, reduced anxiety, improved participation                    |
| Social Learning Theory             | Learning occurs through observation and imitation                     | Teacher modeling, joint action, peer-supported activities  | Improved imitation, cooperation, and peer interaction                             |

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