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Cognitive and emotion-recognition outcomes of the YOTISMA digital intervention for children with autism spectrum disorder: a quasi-experimental study in Morocco

Yassine Annaki[1], Fouad Annaki[2]

[1]Laboratory of Human, Society and Values, Faculty of Humanities and Social Sciences, Ibn Tofail University, Kenitra, Morocco, yassine.annaki@uit.ac.ma , ORCID ID: https://orcid.org/0009-0001-8891-2359
[2]Sidi Mohamed Ben Abdellah University, Fez, Morocco, fouad.annaki@usmba.ac.ma , ORCID ID: https://orcid.org/0000-0002-2276-4744

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ABSTRACT

Digital interventions offer structured and individualized learning opportunities for autistic children, yet evidence from North African contexts remains limited. This study examined the contribution of YOTISMA, an adult-mediated tablet-based program, to the development of cognitive skills and emotion recognition among autistic children in Morocco. A quasi-experimental design was adopted, comparing an intervention group receiving YOTISMA training with a group continuing conventional rehabilitation. A researcher-developed measure was administered before and after the intervention, followed by a short-term reassessment of the intervention group.

Non-parametric analyses indicated significant improvements in cognitive and emotion-recognition performance following

YOTISMA training. The intervention group also achieved higher posttest scores than the comparison group on both outcomes. No statistically significant decline was observed at follow-up, although this finding does not provide conclusive evidence of sustained effects. The results suggest that YOTISMA may complement conventional rehabilitation by supporting targeted cognitive learning and facial-emotion recognition. However, the small non-randomized sample, non-blinded assessment, and reliance on a researcher-developed measure require cautious interpretation.

Further studies using larger samples, standardized instruments, independent evaluators, and longer follow-up periods are needed.

Key words: autism spectrum disorder; cognitive skills; digital intervention; emotion recognition; Morocco; tablet-based learning; YOTISMA**.**

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition marked by substantial variation in communication, social interaction, patterns of behavior, sensory processing, and learning needs [1], [2]. These differences do not imply a uniform cognitive profile. Some children show relative strengths in visual discrimination, detail-focused processing, or rule-based learning while encountering difficulty transferring knowledge across contexts. Emotion recognition may also be challenging, particularly when facial expressions are subtle, dynamic, or embedded in social situations. Educational intervention must therefore be individualized and should distinguish the acquisition of discrete skills from their functional use in everyday environments.

Digital technologies have become increasingly visible in autism education because they can present information in a predictable and visually organized form. Tablet-based activities allow tasks to be repeated without altering their essential structure, provide immediate feedback, and permit progression at an individualized pace. Reviews have nevertheless warned that enthusiasm for technology often exceeds the quality of the available evidence [3]–[6]. Interventions vary in their theoretical foundations, duration, degree of adult mediation, outcome measures, and ecological validity. A digital tool should consequently be evaluated as an instructional arrangement rather than assumed to be effective because it is technologically novel.

The evidence base is also geographically uneven. Most evaluated applications have been designed and tested in high-income settings, while locally developed interventions in North Africa remain comparatively under documented. The transfer of an application across languages and institutional environments is not neutral: vocabulary, images, reinforcement practices, adult roles, and access to devices can influence participation and interpretation. Moroccan associations often work with restricted material resources and combine behavioral, pictorial, and educational practices. A program designed around those conditions may therefore offer evidence that differs from studies of commercially available applications.

YOTISMA was developed as a tablet-based program for children receiving services in a Moroccan autism association. The broader intervention addressed cognitive, daily living, communication, and emotional domains. The present article reports a theoretically focused analysis of two domains: cognitive skills and emotion recognition. This focus does not imply that the original study assessed only two outcomes. Rather, it isolates two complementary forms of learning: discrimination and symbolic knowledge on the one hand, and identification of facially expressed emotions on the other. The article asks whether scores improved following YOTISMA training, whether posttest outcomes differed from conventional rehabilitation, and whether gains were maintained one month later.

2. Literature review and hypotheses

2.1. Digital intervention and structured learning

Computer- and tablet-assisted interventions can reduce irrelevant environmental variation by presenting tasks through consistent visual and auditory cues. This predictability may support attention and repeated responding, especially when the task is brief and the reinforcement contingency is clear. In their meta-analysis, Grynszpan et al. [3] found a positive overall effect of technology-based interventions for autistic participants but also considerable heterogeneity. A systematic review by Aresti-Bartolome and Garcia-Zapirain [4] similarly described potential benefits across communication, learning, and social domains while emphasizing that many studies involved small samples and specialized prototypes.

Portable devices may be particularly useful because they support direct touch, rapid repetition, and flexible placement within teaching routines [5]. Yet the device itself is not the active mechanism. Adult prompting, task sequencing, reinforcement, accessibility, and the match between interface demands and the learner's profile shape engagement. Digital support is best understood as part of a mediated instructional system. This point is consistent with work emphasizing personalization in digitally delivered support [7] and with recent discussion in IJSRIS of neurocognitive and functional approaches to autistic children's learning [8].

2.2. Cognitive skills

The cognitive subscale used in the present study assessed discrimination of colors, numbers, geometric forms, letters, and written names. These tasks draw on visual attention, categorical distinction, symbolic association, and early academic learning. Tablet activities can isolate a relevant cue, permit repeated trials, and provide an immediate response after a selection. O'Malley et al. [9] reported that iPad-based instruction could support academic responding among students with ASD, although benefits varied by learner and implementation. Multitouch activities have likewise been used to structure engagement and collaborative or individual practice [10].

YOTISMA combined digital presentation with modeling, verbal or physical prompting, and reinforcement. Improvement should therefore be attributed to the instructional package rather than to screen exposure alone. On this basis, the first and third hypotheses were formulated: H1 predicted higher cognitive scores at posttest than at pretest within the intervention group; H3 predicted higher posttest cognitive scores for the intervention group than for the comparison group.

2.3. Emotion-recognition skills

Recognizing facial expressions is an important component of social understanding, although it does not represent the full range of emotional competence. Autistic children can differ in attention to facial features, integration of contextual cues, labeling of emotions, and generalization from pictures to live interaction. Digital programs can display expressions repeatedly, control visual complexity, and link a face with a verbal label. The Emotion Trainer study showed that computer-assisted practice could improve aspects of emotion understanding [11]. JeStimule and related serious-game approaches have also explored explicit training of emotion recognition through structured audiovisual activities [12].

The emotional subscale in this study included four items concerning recognition, naming, and discrimination of emotions, specifically happiness, sadness, surprise, and anger. The construct is therefore described as emotion recognition rather than broad emotional functioning. H2 predicted higher emotion-recognition scores after YOTISMA training, while H4 predicted higher posttest scores in the intervention group than in the comparison group.

2.4. Maintenance of outcomes

Immediate improvement does not establish that learning persists after structured practice ends. Follow-up measurement is particularly important when posttest performance may reflect familiarity with the interface or recent reinforcement. The original study reassessed the intervention group after one month, during which no additional digital or rehabilitation program was reported. H5 and H6 predicted no statistically significant posttest–follow-up difference in cognitive and emotion-recognition scores, respectively. These hypotheses concern maintenance, but a non-significant test is not equivalent to formal statistical proof of equivalence.

3. Method

3.1. Design and setting

A small-sample quasi-experimental design was used. The main study included an intervention group and a non-randomized comparison group, with pretest and posttest assessments. The intervention group also completed a follow-up assessment one month later. The fieldwork was conducted at Al-Sabah Autism Association in Fez, Morocco, during the 2020–2021 educational year. The wider psychometric development stage also involved children receiving services in Fez and Taounate.

3.2. Participants

The psychometric pilot sample comprised 30 children aged 8–11 years and was excluded from the outcome analyses. The main sample comprised 20 children diagnosed with ASD by professionals at the participating association using its established clinical procedures. Children were selected after obtaining comparatively low scores on the original four-domain scale. Ten children received YOTISMA training and ten continued conventional rehabilitation. The source thesis reported no baseline group difference on the total four-domain score ($U = 48.50$, $Z = -0.114$, $p = .910$) and described the groups by age, prior rehabilitation, and economic level. It did not, however, report separate baseline comparisons for the two focal subscales, document random allocation, specify diagnostic instruments, or provide sex and ASD-support-level distributions. The design is therefore reported as quasi-experimental, and posttest differences cannot be interpreted as unbiased causal estimates.

3.3. Measures

A researcher-developed 41-item scale originally assessed cognitive, daily living, communication, and emotional skills. Only the cognitive and emotion-recognition subscales are analyzed here. Items were rated on a five-category frequency scale. The cognitive subscale contained 10 items addressing colors, numbers, geometric shapes, letters, and written names. The four-item emotion-recognition subscale assessed identification, naming, and differentiation of selected facial emotions; it did not assess emotional regulation, empathy, or emotional competence broadly. In the independent 30-child pilot sample, Cronbach's alpha was .955 for cognition and .962 for emotion recognition; split-half reliability was .920 and .968, respectively. These estimates suggest high internal consistency but are imprecise in such a small pilot, and no independent convergent or criterion validation was reported.

Table 1. Measures retained for the focused analysis.

Domain	Items	Content	α
Cognitive skills	10	Colors, numbers, forms, letters, written names	.955
Emotion recognition	4	Recognition, naming, and differentiation of emotions	.962

3.4. YOTISMA intervention

YOTISMA was delivered individually through a digital tablet. The complete program comprised introductory meetings with parents and educators, familiarization with the tablet, communication activities, classification and matching tasks, emotion-recognition practice, reading and writing tasks, activities involving colors, numbers, and geometric shapes, educator training, posttest assessment, and follow-up. Most child sessions lasted approximately 30 minutes; selected parent and educator sessions lasted 60 minutes. The instructional techniques included modeling, dialogue, verbal and physical prompting, and reinforcement.

For cognition, children practiced recognizing and differentiating letters, colors, numbers, and shapes through activities displayed on the tablet. For emotion recognition, three sessions presented facial expressions of happiness, sadness, anger, surprise, and disgust and asked children to identify, discriminate, or imitate them. Because YOTISMA combined software, adult mediation, and behavioral teaching procedures, the intervention should not be interpreted as an unguided application.

3.5. Procedure and ethics

The research team contacted association personnel, met with parents, and obtained institutional permission and parental agreement before assessment and intervention. Pretest measurement preceded the training period. The intervention group then completed YOTISMA activities, while the comparison group received usual rehabilitation. Educators participated in implementation and evaluation. Posttest measurement was conducted after the intervention, and the intervention group was reassessed one month later. The source thesis reports parental consent but does not identify a formal research ethics committee approval number; none is therefore claimed in this article. Data are reported only in aggregate form.

3.6. Statistical analysis

SPSS was used for analysis. Given the group sizes of 10, Wilcoxon signed-rank tests compared pretest with posttest and posttest with follow-up in the intervention group, while Mann–Whitney U tests compared groups at posttest. All tests were two-sided with $\alpha = .05$. Standardized effect sizes were calculated as $r = |Z|/\sqrt{N}$, using $N = 10$ for paired tests and $N = 20$ for between-group tests. The analyses are exploratory because no a priori power calculation was available and the two focal baseline distributions were not reported separately by group. A conservative six-test Bonferroni sensitivity check was also considered; the four primary pretest–posttest and posttest between-group findings remained significant (adjusted $p \leq .030$). Exact values from the thesis are reproduced; probabilities displayed as .000 in the original output are reported as $p < .001$.

4. Results

4.1. Pretest–posttest change

All ten children in the intervention group had positive ranks from pretest to posttest on both focal outcomes. Cognitive scores rose from $M = 1.73$ ($SD = 0.91$) to $M = 4.61$ ($SD = 0.38$), $Z = -2.807$, $p = .005$, $r = .89$. Emotion-recognition scores rose from $M = 1.85$ ($SD = 1.09$) to $M = 4.70$ ($SD = 0.51$), $Z = -2.812$, $p = .005$, $r = .89$. H1 and H2 were supported, including under the multiplicity sensitivity check. The uniformly positive ranks and large standardized effects are descriptively strong, but the result remains vulnerable to expectancy, repeated-testing, ceiling, and regression-to-the-mean effects.

Table 2. Experimental-group pretest and posttest results.

Outcome	Pretest M (SD)	Posttest M (SD)	Z	p
Cognition	1.73 (0.91)	4.61 (0.38)	−2.807	.005
Emotion recognition	1.85 (1.09)	4.70 (0.51)	−2.812	.005

4.2. Posttest group comparison

At posttest, the intervention group obtained higher cognitive scores ($M = 4.61$, $SD = 0.38$; mean rank = 15.50) than the comparison group ($M = 1.64$, $SD = 0.50$; mean rank = 5.50), $U = 0.00$, $Z = -3.790$, $p < .001$, $r = .85$. It also obtained higher emotion-recognition scores ($M = 4.70$, $SD = 0.51$; mean rank = 15.30) than the comparison group ($M = 2.27$, $SD = 1.01$; mean rank = 5.70), $U = 2.00$, $Z = -3.684$, $p < .001$, $r = .82$. H3 and H4 were supported, including under the multiplicity sensitivity check. Because focal baseline scores were unavailable by group, these effects describe posttest separation rather than adjusted treatment effects.

Table 3. Posttest comparison between groups.

Outcome	Intervention M (SD)	Control M (SD)	U	Z	p
Cognition	4.61 (0.38)	1.64 (0.50)	0.00	−3.790	<.001
Emotion recognition	4.70 (0.51)	2.27 (1.01)	2.00	−3.684	<.001

4.3. Follow-up

Cognitive scores decreased from $M = 4.61$ ($SD = 0.38$) at posttest to $M = 4.30$ ($SD = 0.27$) at follow-up, $Z = -1.633$, $p = .102$, $r = .52$. Emotion-recognition scores changed from $M = 4.70$ ($SD = 0.51$) to $M = 4.65$ ($SD = 0.34$), $Z = -0.255$, $p = .799$, $r = .08$. H5 and H6 were not rejected. The results are compatible with short-term maintenance, but they do not establish statistical equivalence; the cognitive effect size also cautions against equating non-significance with stability in a sample of ten.

Table 4. Experimental-group posttest and follow-up results.

Outcome	Posttest M (SD)	Follow-up M (SD)	Z	p
Cognition	4.61 (0.38)	4.30 (0.27)	−1.633	.102
Emotion recognition	4.70 (0.51)	4.65 (0.34)	−0.255	.799

5. Discussion

The study found marked improvements in cognitive and emotion-recognition scores following the YOTISMA intervention and large posttest differences relative to conventional rehabilitation. These results are compatible with earlier evidence that visually structured, interactive technologies can facilitate targeted learning for some autistic children [3]–[6]. The findings should, however, be interpreted as outcomes of a combined instructional package. YOTISMA did not operate independently of educators: modeling, prompting, reinforcement, and repeated adult-guided practice were embedded in delivery.

5.1. Cognitive outcomes

The cognitive tasks were concrete and visually discriminable. Colors, shapes, letters, and numbers can be represented consistently on a tablet, and direct touch reduces the distance between stimulus and response. Repetition may have strengthened stimulus discrimination, while immediate feedback could have clarified correct selections. The posttest advantage over the comparison group is consistent with research showing that portable devices can support academic or task-focused performance when activities are individualized [5], [9], [10].

The magnitude of change also raises questions. The experimental mean approached the upper end of a five-point scale, whereas the comparison mean remained low. Such separation may reflect intervention effectiveness, but ceiling effects, evaluator expectancy, repeated exposure to the same scale, or differences in training intensity cannot be ruled out. Future studies should add blinded assessment and standardized cognitive measures, describe dosage precisely, and test transfer to tasks not practiced in the application.

5.2. Emotion-recognition outcomes

Emotion-recognition improvement was similarly pronounced. YOTISMA presented recognizable facial expressions and paired them with explicit labeling, discrimination, and imitation tasks. Controlled presentation may reduce the competing cues present in live social interaction and allow the learner to compare expressions repeatedly. This interpretation is consistent with computer-assisted emotion-training research [11], [12]. The result also complements Bennouna's [8] emphasis on connecting neurocognitive understanding with functional intervention in autistic children's development.

The outcome must nevertheless be delimited carefully. Four items cannot represent emotional competence in its entirety. The measure captures recognition and naming of selected expressions, not spontaneous empathy, emotional regulation, inference of complex mental states, or use of contextual information. Improvement on these items is educationally relevant, but generalization to everyday social encounters remains untested.

5.3. Maintenance and implementation

Scores did not change significantly over the one-month follow-up interval. Emotion-recognition performance was nearly unchanged, whereas cognition showed a descriptive decline. H5 and H6 were therefore not rejected. However, the absence of statistical significance in a group of ten cannot confirm equivalence, and the comparison group was not reassessed at follow-up. The findings should consequently be read as a short-term descriptive pattern rather than proof of sustained effectiveness.

Implementation in a Moroccan association is a substantive contribution. Digital interventions are often discussed as standardized products, yet local use depends on language, adult expertise, device availability, and family participation. YOTISMA incorporated educators and parents into the training sequence. This mediated and context-sensitive arrangement may be more feasible than an application delivered without professional support. As argued in broader discussions of digital personalization [7], technology is most useful when adapted to the learner and the surrounding support system.

6. Implications

For practitioners, the results support considering tablet-based activities as a complement to established rehabilitation rather than as a replacement. Activities should have explicit objectives, limited visual distraction, repeatable response opportunities, and a plan for transferring performance beyond the device. Educators need guidance on prompting and reinforcement so that assistance is gradually reduced rather than becoming a permanent feature of task completion.

For families and associations, locally adaptable programs may expand practice opportunities where specialist resources are limited. Parent access to a monitoring interface, as envisioned in YOTISMA, could help connect center-based practice with home routines. Such use requires attention to screen time, accessibility, data privacy, and the child's willingness to participate. Future co-design should include autistic people, parents, educators, clinicians, and software developers.

For research, the results justify a larger trial with transparent allocation procedures, an active comparison condition of equivalent intensity, blinded evaluators, standardized measures, and longer follow-up. A factorial or dismantling design could distinguish the contribution of the application from prompting and reinforcement. Generalization measures should include novel materials and naturalistic observations.

7. Limitations

Several limitations constrain inference. First, the main sample contained only 20 children from one association, no a priori power analysis was reported, and participant sex, ASD support level, co-occurring conditions, and diagnostic instruments were not documented in sufficient detail. Second, allocation was not documented as random, selection favored low baseline scores, and the two focal baseline distributions were unavailable by group; selection bias, regression to the mean, and baseline imbalance therefore remain plausible. Third, the researcher-developed scale lacked independent convergent or criterion validation, and its very high reliability estimates came from only 30 pilot participants. Fourth, the four-item emotion-recognition subscale cannot support claims about emotional competence broadly. Fifth, implementation personnel appear to have contributed to assessment, creating expectancy and observer bias. Sixth, intervention fidelity, attrition, adverse events, and dosage equivalence with conventional rehabilitation were not reported in enough detail. Seventh, the same measure was used repeatedly, performance approached the scale ceiling, and generalization to untrained or naturalistic tasks was not assessed. Eighth, follow-up included only the intervention group and lasted one month. Finally, this focused report presents two outcomes from a broader four-domain doctoral study; selective-outcome concerns cannot be excluded without a preregistered protocol.

8. Conclusion

In this small, non-randomized study, participation in the adult-mediated YOTISMA program was associated with large improvements in measured cognitive and emotion-recognition performance. The intervention group also showed large unadjusted posttest differences relative to conventional rehabilitation. The one-month results did not detect statistically significant change, but they cannot establish maintenance or equivalence. Accordingly, the study supports the feasibility and further evaluation of a culturally situated tablet-based instructional package; it does not establish causal effectiveness, superiority of the digital component, or generalization to everyday functioning. A larger preregistered trial with concealed allocation, focal baseline measurement, blinded independent assessment, standardized outcomes, fidelity monitoring, an intensity-matched comparison condition, and longer follow-up is required.

Data availability

The data were collected as part of a doctoral research project involving children. De-identified data and analysis materials may be requested from the corresponding author, subject to participant-consent limits and institutional and ethical authorization; public deposition is not claimed.

Conflict of interest

The author declares no conflict of interest.

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Origin of the study

This article draws on data collected as part of a broader doctoral research project. The original study assessed four skill dimensions; the present analysis focuses on cognitive and emotion-recognition outcomes because of their theoretical relevance to structured digital learning.

References

[1] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 5th ed., text rev., American Psychiatric Association Publishing, Washington, DC, USA, 2022.

[2] World Health Organization, 'Autism', WHO Fact Sheet, Geneva, Switzerland, 2025, https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders.

[3] O. Grynszpan, P.L. Weiss, F. Perez-Diaz, and E. Gal, 'Innovative technology-based interventions for autism spectrum disorders: A meta-analysis', Autism, Vol. 18, No. 4, pp. 346–361, 2014.

[4] N. Aresti-Bartolome and B. Garcia-Zapirain, 'Technologies as support tools for persons with autistic spectrum disorder: A systematic review', International Journal of Environmental Research and Public Health, Vol. 11, No. 8, pp. 7767–7802, 2014.

[5] D.M. Kagohara, L. van der Meer, S. Ramdoss, M.F. O'Reilly, G.E. Lancioni, T.N. Davis, M. Rispoli, R. Lang, P.B. Marschik, D. Sutherland, V.A. Green, and J. Sigafoos, 'Using iPods and iPads in teaching programs for individuals with developmental disabilities: A systematic review', Research in Developmental Disabilities, Vol. 34, No. 1, pp. 147–156, 2013.

[6] S. Boucenna, A. Narzisi, E. Tilmont, F. Muratori, G. Pioggia, D. Cohen, and M. Chetouani, 'Interactive technologies for autistic children: A review', Cognitive Computation, Vol. 6, pp. 722–740, 2014.

[7] E.H. El Bazi and J. Boumaajoune, 'Digital coaching: Personalization, adaptation and challenges', International Journal of Scientific Research and Innovative Studies, Vol. 3, No. 6, pp. 1–10, 2024, https://www.ijsrisjournal.com/index.php/ojsfiles/article/view/220.

[8] A. Bennouna, 'Elective language in children on the autism spectrum: From neurocognitive therapy to the development of receptive and expressive communication skills', International Journal of Scientific Research and Innovative Studies, Vol. 5, No. 4, pp. 526–538, 2026, https://www.ijsrisjournal.com/index.php/ojsfiles/article/view/868.

[9] P. O'Malley, J. Lewis, and C. Donehower, 'Using tablet computers as instructional tools to increase task completion by students with autism', Focus on Autism and Other

Developmental Disabilities, Vol. 29, No. 3, pp. 151–162, 2014.

[10] J.P. Hourcade, N.E. Bullock-Rest, and T.E. Hansen, ‘Multitouch tablet applications and activities to enhance the social skills of children with autism spectrum disorders’, Personal and Ubiquitous Computing, Vol. 16, pp. 157–168, 2012.

[11] M. Silver and P. Oakes, ‘Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognize and predict emotions in others’, CyberPsychology & Behavior, Vol. 4, No. 3, pp. 299–316, 2001.

[12] S. Serret, S. Hun, G. Iakimova, J.-L. Lozada, S. Anastassova, A. Santos, J. Vesperini, and F. Askenazy, ‘Facing the challenge of teaching emotions to individuals with low- and high-functioning autism using a new serious game: A pilot study’, Molecular Autism, Vol. 5, Article 37, 2014.