IES Institute of Education Sciences

Red Light, Purple Light

Intervention Report | *Preparing Young Children for School*

WHAT WORKS CLEARINGHOUSE™
December 2022

WWC 2023-002
U.S. DEPARTMENT OF EDUCATION

Developing self-regulation at an early age is important for children's success in school and in life.[1] Self-regulation involves the ability to remember instructions, shift attention from one thing to another, and reduce the intensity and frequency of impulsive emotions and behaviors. *Red Light, Purple Light* is a preschool program that includes music and movement games aimed at fostering self-regulation skills in young children.

Goal: *Red Light, Purple Light* aims to support children in remembering instructions, switching their attention from one rule to another, and inhibiting impulsive behaviors and emotions.

The What Works Clearinghouse (WWC) reviews existing research on educational interventions to identify evidence-based programs and practices. This WWC intervention report summarizes the available evidence on the effects of *Red Light, Purple Light* on student outcomes.

Did *Red Light, Purple Light* improve student outcomes?

Two studies of *Red Light, Purple Light* conducted in Head Start centers meet WWC standards. Findings from these studies are summarized in Table 1. The table includes rows for each outcome domain–a group of related outcome measures–that was studied in the research. Effects of the program on other student outcomes are unknown.

The WWC effectiveness rating indicates whether *Red Light, Purple Light* resulted in improved outcomes for children assigned to receive the program compared with children who were not.

The table also indicates whether the evidence reviewed satisfies the Departments of Education's requirements for strong, moderate, or promising tiers of evidence at the time this report was written. More information about these ratings and requirements is provided on the next page. The findings and conclusions could change as new research becomes available.

Table 1. Summary of findings on *Red Light, Purple Light* from two studies that meet WWC standards

Outcome domain	Effectiveness rating	Sample size	Evidence tier	Summary
Self-Regulation	Potentially positive	433	TIER 2 MODERATE	The research provides moderate evidence that *Red Light, Purple Light* improved student self-regulation. This assessment is based on two studies that meet WWC standards.
Mathematics	Uncertain	433	NO TIER ASSIGNED	The research does not support claims that *Red Light, Purple Light* improved student mathematics achievement. This assessment is based on two studies that meet WWC standards.
Reading & Literacy Related	Uncertain	433	NO TIER ASSIGNED	The research does not support claims that *Red Light, Purple Light* improved student reading and literacy related achievement. This assessment is based on two studies that meet WWC standards.
Language	Uncertain	276	NO TIER ASSIGNED	The research does not support claims that *Red Light, Purple Light* improved student language. This assessment is based on one study that meets WWC standards.

FINDINGS FROM TWO STUDIES

433 children in Head Start centers in the Pacific Northwest region.

CHILDREN IN PRESCHOOL

Race:

White: 26%, Black: 6%, Native Hawaiian or Other Pacific Islander: 7%, Other/unknown: 61%

Ethnicity: 58% Hispanic/Latino

English Language Learners: 33%

Gender: 51% Female

Families with incomes below the poverty guidelines: 100%

HOW THE WWC REVIEWS AND DESCRIBES EVIDENCE

The WWC conducted a systematic review of interventions designed to improve children's level of preparation for school and selected and prioritized studies for review using the version 4.1 Review Protocol for Preparing Young Children for School. The WWC evaluated the quality and results of the selected studies using the criteria outlined in the version 4.1 Procedures and Standards Handbooks and the accompanying Review Protocol for Preparing Young Children for School.

The WWC considers each study's research design, whether findings were statistically significant and positive, and the number of studies contributing to this report. The WWC synthesizes evidence across studies—using a weighted average—to determine the effectiveness rating for each outcome domain. The WWC defines outcome domains in the Review Protocol for Preparing Young Children for School to group related outcome measures.

Effectiveness rating	Description of the evidence
Positive (or negative) effects	The evidence base primarily includes the strongest research designs, and the average effect across all high-quality research is statistically significant and positive (or negative).
Potentially positive (or negative) effects	The evidence base primarily includes research with some limitations, and the average effect across all high-quality research is statistically significant and positive (or negative).
Uncertain effects	The average effect across all high-quality research is not statistically significant, so the WWC does not classify it as a positive or a negative effect.

The WWC considers the effectiveness rating, the sample size, and the number of educational sites (states, districts, local education agencies, schools, postsecondary campuses) across studies to determine the evidence tier for each outcome domain. When the effectiveness rating is *uncertain*, *potentially negative*, or *negative effects*, there is no evidence tier.

Evidence tier		Criteria based on evidence synthesis
Strong evidence of effectiveness	TIER 1 STRONG	• Receives an effectiveness rating of positive effects, and • Includes at least 350 students in at least two educational sites
Moderate evidence of effectiveness	TIER 2 MODERATE	• Receives an effectiveness rating of potentially positive effects, and • Includes at least 350 students in at least two educational sites
Promising evidence of effectiveness	TIER 3 PROMISING	• Receives an effectiveness rating of potentially positive effects or positive effects • Includes fewer than 350 students or two educational sites

How was *Red Light, Purple Light* implemented?

This section provides details of how Head Start centers implemented *Red Light, Purple Light* in the two studies that contribute to this intervention report. This information can help educators identify the requirements for implementing *Red Light, Purple Light* and determine whether implementing this program would be feasible in their districts, schools, or early childhood education centers.

Teachers implementating the *Red Light, Purple Light* sessions received a 3-hour in-person training and a kit of materials provided by the developer. Teachers implemented the *Red Light, Purple Light* sessions for approximately 20 minutes during circle time. The *Red Light, Purple Light* sessions took place twice a week for 8 weeks. Table 2 describes the components and implementation of *Red Light, Purple Light* in more detail.

WWC standards assess the quality of the research, not the quality of the implementation. Studies that meet WWC standards vary in quality of implementation. However, a study must describe the relevant components of the program and how each was implemented with adequate detail to be included in an intervention report.

Comparison condition: In the two studies that contribute to this intervention report, children in the comparison group were taught by teachers who did not participate in *Red Light, Purple Light* training and who did not implement the *Red Light, Purple Light* sessions. Teachers may have participated in other training or professional development programs offered by their district, school, or early childhood education center.

Table 2. Implementation of components of *Red Light, Purple Light*

Component	Description of the component	How it was implemented
Greeting Song	The greeting song is a consistent opening to the session that allows children to prepare themselves for the upcoming game.	The teachers in both studies led the children in a welcome song and encouraged the children to participate by holding hands, clapping to the beat of the song, or performing simple dance moves.
Music and Movement Games	The five music and movement games are variations of the game *Red Light, Green Light* often played in schools.	The teachers in both studies told children which action to do in response to a visual or oral cue. As the games progressed, the teacher increased the complexity of the game by asking children to perform the action for the opposite cue or by adding more cues and actions. For example, the teachers began by asking children to walk when a green circle was shown and stop walking when a red circle was shown. Later, the teacher asked the children to stop when the green circle was shown and walk when the red circle was shown. Alternatively, the teacher asked the children to clap when a blue circle was shown and stomp their feet when an orange circle was shown. Children were also given an opportunity to present the cues and actions. The games were conducted during circle time.
Goodbye Song	The goodbye song is a consistent closing activity. It provides time for the group to sing a song saying goodbye and end the session.	The teachers led children in a goodbye song to close the session and encouraged the children to participate by holding hands, clapping to the beat of the song, or performing simple dance moves.

Note: The descriptive information for this program comes from the program website https://health.oregonstate.edu/labs/kreadiness/intervention, the two studies that meet WWC standards, and from correspondence with the developer. The WWC requests that developers review the program description sections for accuracy from their perspective. The WWC provided the developer with the program description in April 2022, and the WWC incorporated feedback from the developer.

How much does *Red Light, Purple Light* cost?

This section provides educators with an overview of the resources needed to implement *Red Light, Purple Light*. Table 3 describes the major resources needed for implementation and approximate costs, based on information available as of April 2022.

Table 3. Resources needed to implement *Red Light, Purple Light*

Resource	Description	Funding source
Training	According to the developer, teachers need a half-day (3-hour) training in person. The in-person training starts at $1,000 for up to 30 individuals within 60 miles of Oregon State University or $260 per person for asynchronous virtual training.	The developer provided the in-person training to the program teachers in the studies. The studies did not describe how the schools purchased the training.
Training Manual	According to the developer, teachers need the printed training manual ($30 per manual) for the in-person training or the downloadable PDF of the training manual ($25 per manual) for the online training.	The developer provided the training manuals to the program teachers in the studies. The cost was included in the price of the training.
Materials	The developer provides a list of materials necessary for implementing the program. If teachers do not have the materials available at their centers, they can purchase one of three kits of materials. The base kit includes a training manual, laminated circles, 24 egg shakers, a baton, a train whistle, and a USB with music files. The larger two kits also include a drum or a drum and the related text *Stop, Think, Act* by the developers McClelland and Tominey. The cost ranges from $75–$150 per kit.	The developer provided the material kits to the program teachers in the studies.

For More Information:

About *Red Light, Purple Light*

349 Hallie E. Ford Center for Healthy Children & Families
2631 SW Campus Way
Oregon State University
Corvallis, Oregon 97331
The Kindergarten Readiness Study
Email: kreadiness@oregonstate.edu Web: https://health.oregonstate.edu/labs/kreadiness/intervention. Phone: (541) 737-1474

About the cost of the intervention

Web: https://health.oregonstate.edu/labs/kreadiness/intervention

What research did the WWC review about *Red Light, Purple Light*?

This section provides details about the studies of *Red Light, Purple Light* that the WWC examined in its systematic review, including (1) how the WWC rated the quality of the available research, (2) how the WWC summarized findings in the two studies that meet WWC standards, and (3) the characteristics of the studies that meet WWC standards.

The quality of evidence in the available research about *Red Light, Purple Light*

The WWC identified six studies that investigated the effectiveness of *Red Light, Purple Light* from a literature search in the Education Resources Information Center (ERIC) and other databases of research studies from January 2005 to January 2022. Of these six studies, two meet WWC standards and contribute to the summary of evidence in this intervention report. Studies that either do not meet WWC standards or are ineligible for review do not contribute to this intervention report.

- **One study meets WWC standards without reservations.** One study was a cluster randomized controlled trial with low cluster-level attrition and individual-level non-response.
- **One study meets WWC standards with reservations.** One study was a cluster randomized controlled trial with high individual-level non-response but the study provides evidence of effects on individuals by satisfying the baseline equivalence requirement for the individuals in the analytic intervention and comparison groups.
- **One study does not meet WWC standards.** One study included a confounding factor so that the estimates of effectiveness cannot be attributed solely to the introduction of *Red Light, Purple Light*.
- **Three studies are ineligible for review.** One study was conducted outside the United States. One study did not include an eligible measure of the effectiveness of the program. One study did not use an eligible design to study the impact of the program.

The citations for these six studies are included in the references. For information on how the WWC determines study ratings, see the *WWC Procedures and Standards Handbooks, Version 4.1*, WWC Standards Briefs, and the Review Protocol for *Preparing Young Children for School*, available on the WWC website.

More details about the two studies of *Red Light, Purple Light* that meet WWC standards

The two studies that meet WWC standards examined the effects of *Red Light, Purple Light* on five measures of self-regulation, two measures of mathematics achievement, one measure of reading and literacy achievement, and one measure of language. Table 4 lists, for each outcome measure, the name of the measure, when it was assessed, the sample and setting, the means and standard deviations for the *Red Light, Purple Light* and comparison groups, the effect size, the improvement index, and whether the WWC determined the finding to be statistically significant.

Red Light, Purple Light had *potentially positive effects* on self-regulation because the average effect across all outcomes was statistically significant. The program had a statistically significant and positive effect on two of the five self-regulation measures. The program had *uncertain effects* for the mathematics domain, reading and literacy related domain, and language domain because the average effect across all outcomes and studies in each domain was not statistically significant. For the mathematics domain, while the program had a statistically significant and positive effect on one outcome measure, the finding for the other outcome measure was not statistically significant. For the reading and literacy related domain and the language domain, the findings were not statistically significant.

Table 5 describes characteristics of the two studies of *Red Light, Purple Light* that meet WWC standards, including the study setting and participants.

What is an effect size? The effect size is a standardized measure of the impact of an intervention that can be synthesized across outcome measures and studies. A positive effect size favors the intervention group and a negative effect size favors the comparison group. Effect sizes further away from 0 means there was a larger difference between the groups.

What is an improvement index? The improvement index is another measure of the intervention's impact on an outcome. The improvement index can be interpreted as the expected change in percentile rank for an average comparison group student if that student had received the intervention. For example, an improvement index of +5 means that a comparison group student at the 50th percentile would have scored at the 55th percentile if they had received the intervention. The effect size and improvement index measure the same concept in different units, similar to meters and feet for distance.

What is statistical significance? A finding is statistically significant if the difference between the intervention and comparison group means was large enough that it is unlikely to have been obtained for an intervention without a true impact. The WWC considers *p*-values less than 0.05 to be statistically significant.

Table 4. Findings by outcome domain from two studies of *Red Light, Purple Light* that meet WWC standards

Outcome	Timing of measurement	Study sample	Number of sites	Unadjusted means (standard deviations)		Findings		
				Intervention group	Comparison group	Effect size	Improvement index	Statistically significant (*p*-value)
Self-regulation outcome domain								
Day-Night Stroop task (McClelland et al., 2019)	End of 8 weeks of implementation	157 children in preschool	7 sites in the Pacific Northwest	22.75 (9.13)	21.60 (10.34)	0.049	+2	No (p=0.850)
Head-Toes-Knees-Shoulders-Revised (HTKS-R) (McClelland et al., 2019)	End of 8 weeks of implementation	157 children in preschool	7 sites in the Pacific Northwest	37.43 (31.79)	41.52 (27.61)	0.218	+9	No (p=0.164)
Child Behavior Rating Scale (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	35.75 (8.29)	34.14 (7.54)	-0.049	-2	No (p=0.746)
Dimensional change card sort task (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	10.97 (5.98)	10.31 (6.04)	0.212	+8	Yes (p=0.036)
Head-Toes-Knees-Shoulders (HTKS) (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	12.53 (15.33)	8.75 (13.62)	0.335	+13	Yes (p=0.004)
Summary for self-regulation: potentially positive effects						**0.16**	**+6**	**Yes**
Mathematics outcome domain								
Preschool Early Numeracy Skills Screener – Brief Version (PENS-B) (McClelland et al., 2019)	End of 8 weeks of implementation	157 children in preschool	7 sites in the Pacific Northwest	8.72 (5.51)	8.94 (5.69)	0.314	+12	Yes (p=0.006)
Woodcock-Johnson III Tests of Achievement (WJ-III) Applied Problems Subtest (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	397.45 (28.03)	395.46 (23.94)	-0.001	0	No (p=0.994)
Summary for mathematics: uncertain effects						**0.12**	**+5**	**No**
Reading & Literacy Related outcome domain								
Woodcock-Johnson III Tests of Achievement (WJ-III) Letter-Word Identification Subtest (McClelland et al., 2019)	End of 8 weeks of implementation	157 children in preschool	7 sites in the Pacific Northwest	328.08 (22.86)	331.09 (25.83)	0.031	+1	No (p=0.802)
Woodcock-Johnson III Tests of Achievement (WJ-III) Letter-Word Identification Subtest (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	325.51 (23.71)	322.99 (24.06)	0.134	+5	No (p=0.418)
Summary for reading & literacy related: uncertain effects						**0.09**	**+4**	**No**

Outcome	Timing of measurement	Study sample	Number of sites	Unadjusted means (standard deviations)		Findings		
				Intervention group	Comparison group	Effect size	Improvement index	Statistically significant (*p*-value)
Language outcome domain								
Woodcock-Johnson III Tests of Achievement (WJ-III) Picture Vocabulary subtest (Schmitt et al., 2015)	End of 8 weeks of implementation	276 children in preschool	9 sites in the Pacific Northwest	458.68 (16.09)	458.11 (14.52)	-0.018	-1	No (p=0.910)
Summary for language: uncertain effects						**-0.02**	**-1**	**No**

Note: The effect sizes and improvement indices are adjusted for baseline group differences.

Table 5. Characteristics of the two studies of *Red Light, Purple Light* that meet WWC standards

What was the study design?	Both studies used similar cluster randomized controlled trial designs. The authors randomly assigned teachers to either participate in the *Red Light, Purple Light* training and implement the sessions or to continue with business as usual.
What was the WWC study rating?	**McClelland et al. (2019)** • This study is rated Meets WWC Group Design Standards Without Reservations because it is a cluster randomized controlled trial with low cluster-level attrition and individual-level non-response. **Schmitt et al. (2015)** • This study is rated Meets WWC Group Design Standards With Reservations because there is high individual-level non-response but the study provides evidence of effects on individuals by satisfying the baseline equivalence requirement for the individuals in the analytic intervention and comparison groups.
Where did the study occur?	**McClelland et al. (2019)** • This study took place in 7 preschool sites and 13 Head Start classrooms in the Pacific Northwest. **Schmitt et al. (2015)** • This study took place in 9 preschool sites and 14 Head Start classrooms in the Pacific Northwest.
Who participated in the study?	**McClelland et al. (2019)** • The intervention condition included children taught by 6 teachers in 10 Head Start classrooms. The comparison condition included children taught by 2 teachers in 3 Head Start classrooms. The total number of children for both the intervention and comparison conditions was 157 children. • The children ranged in age from 38 to 62 months. Fifty-eight percent of the children were Hispanic or Latino, 26% were non-Hispanic White, 7% were non-Hispanic Asian, 6% were non-Hispanic Black, and 2% reported Other for ethnicity. Approximately half the children were female, and 33% of the children were English learners. All of the families of the children were below the poverty threshold for Head Start. **Schmitt et al. (2015)** • The intervention condition included children taught by 7 teachers in 7 Head Start classrooms. The comparison condition included children taught by 7 teachers in 7 Head Start classrooms. The total number of children for both the intervention and comparison conditions was 276 children. • The children ranged in age from 38 to 66 months. Approximately half the children were female, and 33% of the children were English learners. All of the families of the children were below the poverty threshold for Head Start.

References

Studies that meet WWC standards without reservations

McClelland, M. M., Tominey, S. L., Schmitt, S. A., Hatfield, B., Purpura, D., Gonzales, C., & Tracy, A. (2019). Red Light, Purple Light! Results of an intervention to promote school readiness for children from low-income backgrounds. *Frontiers in Psychology, 10*(2365), 1-15. https://eric.ed.gov/?id=ED599347

Studies that meet WWC standards with reservations

Schmitt, S. A., McClelland, M. M., Tominey, S. L., & Acock, A. C. (2015). Strengthening school readiness for Head Start children: Evaluation of a self-regulation intervention. *Early Childhood Research Quarterly, 30*, 20-31. https://doi.org/10.1016/j.ecresq.2014.08.001

Studies that do not meet WWC standards

Tominey, S. L., & McClelland, M. M. (2011). Red light, Purple Light: Findings from a randomized trial using circle time games to improve behavioral self-regulation in preschool. *Early Education & Development, 22*(3), 489-519. https://eric.ed.gov/?id=EJ927309

Studies that are ineligible for review under the study review protocol

Duncan, R. J., Schmitt, S. A., Burke, M., & McClelland, M. M. (2018). Combining a kindergarten readiness summer program with a self-regulation intervention improves school readiness. *Early Childhood Research Quarterly, 42*, 291-300. https://doi.org/10.1016/j.ecresq.2017.10.012

Keown, L. J., Franke, N., & Triggs, C. M. (2020). An evaluation of a classroom-based intervention to improve executive functions in 4-year-old children in New Zealand. *Early Childhood Education Journal, 48*(5), 621-631. https://eric.ed.gov/?id=EJ1261957

Li, T., McClelland, M. M., Tominey, S. L. & Tracy, A. (2021). Cost-effectiveness analyses on various models of the Red Light, Purple Light self-regulation intervention for young children. *Frontiers in Psychology, 12*(711578). https://doi.org/10.3389/fpsyg.2021.711578

Additional sources

The WWC examined additional sources (such as preliminary reports, working papers, or other associated publications) related to the citations in the references to complete its review of these studies. The additional sources are listed on the WWC pages for each study review.

How possible conflicts of interests were addressed when preparing this report

McClelland led and/or contributed to the development of *Red Light, Purple Light* program, as well as one of the measures used to assess the program's impacts. She co-authored articles that were reviewed and used for evidence for this intervention report. She is one of the instructors for the *Red Light, Purple Light*: *A Self-Regulation Intervention Program* training, which uses a book she co-authored and which is commercially available. The intervention report was prepared by the WWC contractor. The WWC contractor was not involved in developing the program or studying its effectiveness and has no financial interest in the program. All studies that meet WWC standards and the synthesis of their findings were checked and verified through a peer-review process. The Statistics, Website, and Training (SWAT) team conducted an independent review of the evidence to ensure that the WWC's findings are accurate.

Recommended Citation

What Works Clearinghouse, Institute of Education Sciences, U.S. Department of Education. (2022, December). *Red Light, Purple Light*. https://whatworks.ed.gov

---

[1] Dodge, K. A., Bai, Y., Ladd, H. F., & Muschkin, C. G. (2017). Impact of North Carolina's early childhood programs and policies on educational outcomes in elementary school. *Child Development*, *88*(3), 996-1014. https://eric.ed.gov/?id=EJ1140481; Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani, L. S., Feinstein, L., Engel, M., Brooks-Gunn, J., Sexton, H., Duckworth, K., & Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*(6), 1428-1446. https://eric.ed.gov/?id=EJ779938; Phillips, D., Lipsey, M., Dodge, K. A., Haskins, R., Bassok, D., Burchinal, M. R., & Weiland, C. (2017). *Puzzling it out: The current state of scientific knowledge on pre-kindergarten effects*. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2017/04/consensus-statement_final.pdf; Vandell, D. L., Burchinal, M., & Pierce, K. M. (2016). Early childcare and adolescent functioning at the end of high school: Results from the NICHD Study of Early Child Care and Youth Development. *Developmental Psychology*, *52*(10), 1634-1645. https://eric.ed.gov/?id=EJ1116022; Yoshikawa, H., Weiland, C., & Brooks-Gunn, J. (2016). When does preschool matter? *The Future of Children*, *26*(2), 21-35. https://eric.ed.gov/?id=EJ1118535.