Reconsidering Everyday Assessment in the Art Classroom: Ceramics and Science

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Educational assessment is more than measurement, rubrics, and grades. Its real focus needs to be on learning. Art educators need to pay attention to the assessment of daily learning as well. Everyday assessment of classroom learning is crucial because it provides feedback directly to students in the process of their learning, more than mere measurement or rubric ranking does. Teachers should provide opportunities for students to learn how to pre-assess and post-assess their own learning, compare the results of their first assignment with a later one, problem-solve and reflect collaboratively, evaluate their own artwork, draw pictures of and measure what they learn, and provide suggestions about their works in the future. This should start at the middleschool level, when students are interested in technical concerns, scientific wonders, and how things work (Brewer 1991).

My arguments mostly stem from J. Myron Atkin and Janet Coffey's book, *Everyday Assessment in the Science Classroom* (2003). Examples emerged from my teaching experience in a course on ceramics and science for middleschool students that demonstrated how assessment results can guide program development, curriculum design, and classroom instruction. This article explores the quality of everyday assessment, the means of assessment, and what can be accepted as evidence of learning in visual art education. Art educators need practical and accessible examples that translate at the classroom level.

The State of General Assessment in the Arts

At the federal level, only general guidelines and sample assessments in arts education have been promoted. For example, the National Standards for Arts Education stipulate that students need to learn to generalize about the effects of visual structures and functions and reflect on these effects in their own work (ArtsEdge 2005). The National Assessment of Educational Progress (NAEP) examined art criticism skills and knowledge of sample art concepts, such as collage and metamorphosis (U.S. Department of Education Office of Educational Research and Improvement 1998). Most states' fine arts standards offer general guidelines for instruction, but content is left to the individual teacher. The Arizona Arts Standards, for example, stipulate that technique, media, and knowledge be taught. The standards require teachers to develop students' critical-thinking skills, enable them to evaluate art based on evidence, promote student self-assessment, use a variety of appropriate formal and informal assessments, and give students feedback on their progress (Arizona Department of Education 2003). The problem is the lack of models that suggest questions, skills, concepts, evidence, or thinking processes that should be learned.

New teachers, therefore, tend to teach the way they were taught in studio classes. Simultaneously, school districts may sometimes stipulate certain concepts be taught at certain age levels. Another problem is that most instructional assessment guidelines deal with two-dimensional artworks and evaluating portfolios (Gitomer, Grosh, and Price 1992). Such guidelines are for assessing artwork and are not intended for assessing everyday knowledge. There is a shortage of models about how assessments can best be designed and implemented in everyday classroom conversation. Lemke studied high school science discourse and argued for classroom dialogue, saying "The richer the art talk, the richer the teaching and learning" (1990, 15). In art education, Cotner (2001) suggests other reasons to study classroom art talk: Art is a graduation requirement in many high schools, but teachers are resistant to discipline-based approaches. Teachers and students rely on classroom talk, a kind of oral review, rather than a written test.

Assessment Should Improve Not Only Measure Student Learning

Atkin and Coffey (2003) argue for learning-centered assessment that is local and contextual and concerned with skills, knowledge, and discipline or learner priorities rather than simply focusing on sets of measurement protocols. Teaching demands developing clear and meaningful objectives, specific criteria for achieving them, and quality feedback to prove that learning took place. The authors also advocate student participation in everyday assessment. This type of involvement demands arranging opportunities in six areas that include time, traditional assessments, public display of work, reflection and revision, and goal setting (Coffey 2003, 84–85). This form of assessment should go beyond the use of a rubric which "merely judges a work and does not provide students with information for improvement of performance" (Davies 2003, 18).

Teachers need to employ classroom-based assessment examples that build a range of mental models of success and improvements. Davies pointed out that "an event is not an experience until you reflect on it. . . . This is a process of confirmation, consolidation, and integration of new knowledge" (2003, 17). Confirmation is a process of giving evidence or verifying choices. Consolidation is a way of explaining something and making it coherent and to the point. This enables students to integrate their own comments and questions rather than merely recite textbook knowledge. Integration of new knowledge is the ability to combine different areas of knowledge.

In art education, Nelson and Chandler attempted to heighten in-service teachers' curiosity toward a more integrated method of teaching art and science. The authors studied the teachers' two-dimensional machinations (plots or inventions) and encouraged them to reflect on their strategies. They discovered that teachers had different viewpoints. Some preferred to simplify details, while other teachers were inclined to maximize them (1999, 44). Such studies may open students' perspective-taking tools.

Teachers need to employ classroom-based assessment examples that build a range of mental models of success and improvements. The following are examples of ways in which teachers can use everyday assessment strategies for learning about the art and science of ceramics.

An Example of Middle School Students Learning about Ceramics and Science

During the summer of 2003, I taught a course called "Earth's Wares: Ceramics through the Study of Science and Indigenous Cultures" as part of the Programs for Gifted Middle School Students at Arizona State University. The poster for the course description ran as follows:

> Earth's Wares is a meeting of students who seek the academic, physical, and artistic challenge of working in clay. Experiences will range from making pinch and coil pots to slab relief and architecture. In this course students will learn about glaze calculations (chemistry), kiln firing (physics), and the constitution and selection of clay (geology). Students will also study Native American and contemporary pottery.

Major student performance objectives, described on the course poster, included the following:

- Explore a clay pot by describing, analyzing, interpreting, and judging it
- Discuss the scientific method as one of inquiry, consisting of asking questions, problem solving, making plans, experimenting with forms, using different designs, documenting ideas, and evaluating results
- Investigate the geology of clay, rocks, and minerals; the process of mining, and examine the chemistry of glazes
- Compare different firing processes and the physical changes of clay
- Make a pinch pot and coil pot with different designs
- Calculate glaze formulas and learn about the chemistry of glazes
- Discuss architectural structures, compare indigenous adobe to modern concrete materials, lay out the design of a town plan, and, in small groups, form clay models of the structures that they design
- Experiment with different assessment methods

Overview of the Course Content

The course began with students answering a questionnaire and creating a pinch pot. Ceramic production activities included making a coil pot, a sculptural relief, and an architectural city in small groups. Students visited the university's Ceramics Research Center and examined pots of their choice using art criticism questions. To motivate students to make their own coil pottery, I showed a video of the famous potter Maria Martinez from the San Ildefonso Pueblo in New Mexico demonstrating and analyzing her coil pot construction and pit firing methods.

Students studied methods of coil construction, which involves scoring and slipping and smoothing coil walls, along with the usage of a caliper to measure thickness. They tried different decorative elements, including stamping, carving, clay parts, or applying black, white, or red liquid-clay underglazes, similar to the method of Maria Martinez. In this way students learned about native ceramic clay and firing processes. They also visited the university's ceramic studios to learn about different clays, such as earthenware, high-fired stoneware, and terracotta with grog that makes the clay stronger, so it can dry out faster. A ceramics graduate student demonstrated how to make simple glaze calculations, involving math and chemistry. They also learned that most glazes consist of 50 percent silica that melts at a high temperature, flux (boric oxide, soda, or potassium) to lower the temperature, and colorants (for example, cobalt blue and copper green metallic oxides). All these ingredients are mixed with water and applied on test tiles. They learned about basic glazes that are glossy, transparent, matte or opaque, metallic, salt, and over- or underglazes. With graduate student assistance, students measured and mixed cobalt and copper matte low-fired glazes that they later brushed on their own pots.

While visiting the university ceramic studios, gifted students observed graduate students using other methods of decorating ceramic ware such as incising, appliqué, and wax resist.

During the second week, I introduced several types of rocks (igneous, metamorphic, and sedimentary), mineral tests, and oxides, and I taught students how to stain their pots using the oxides. A video about mining and worksheets followed. Students later identified different cave formations (for example, a stalactite, a hanging conical shape, or a stalagmite, standing on the floor) on a worksheet from a geology workbook. Students participated in a raku firing, assisting with the loading and unloading of the kiln. After I demonstrated how to model a clay relief, each student produced one on a theme of his or her choice, expecting to stain it at home.

During the last week, I introduced a unit on clay architecture by presenting a video of Paolo Soleri, a contemporary architect who advocates the integration of organic forms (Native American adobe) and ecology (which he terms "arcology") into architectural design. Students then drew floor plans and built clay cities with the addition of clay props and human figurines (not described here due to space limitations). The course ended with questionnaires, interviews, and student drawings of what they learned. The next section includes some strategies and examples of everyday assessment in the ceramics classroom that art teachers can use with any other art form.

Suggestions for Everyday Assessment

Pre-assess student knowledge. Using Coffey's (2003) recommendation to incorporate traditional assessment devices, I gave a questionnaire to understand students' preconceptions about ceramics and previous clay experiences, so I could compare them with what they learned in the course. My first question was "What is ceramics?" Students initially conceived of ceramics as working with clay (six of eleven students) and making and sculpting things (five of eleven). When I asked the question, "What is science?" students gave various answers: the study of the world around us, how systems of the world work, results of experiments, and knowledge of nature. I next asked, "What was your previous experience with clay?" A few girls had had some experience making pinch pots in school. Then I asked, "Name a famous ceramic artist." Most students knew of no ceramic artists, and two students mentioned a local ceramic artist. Finally, I asked, "What does the word 'indigenous' mean?" A frequent answer was "I don't know." One student guessed the meaning to be "a small traditional culture" and another student surmised, "a culture that studied earthenware." The answer was, of course, implicit in the title of the course, "The Earth's Wares: Ceramics through the Study of Science and Indigenous Cultures."

Include a pretest without any teaching. Students and teachers need to see growth from their first art piece to their last. In this case, students could see this growth by making, for example, a pinch pot without instruction, so they might later see how much they have learned by comparison. Several students in the class discovered that the bases of their pinch pots were too thin, even after I had warned them to make their pots extra-thick at the bottom.

Engage students in the process of everyday assessment. Everyday classroom assessment is a dynamic process that involves interactions between teachers and students. Coffey suggested that in assessing, teachers should take the meaning of this word's Latin root: *assidere*, which means, "to sit with." When this advice is taken, teachers and students together examine the quality of students' work to facilitate their learning. They discuss "clear criteria, improving questioning, and providing feedback" (2003, 77). This also involves students reflecting about what and how they are learning and providing evidence to support their appraisal. This assessment process is not easy, but this reflective activity leads to lifelong learning, which is a process of developing questions about what students still do not understand, and strategies for obtaining further assistance.

Expect initial student uneasiness with assessment. Students have little understanding of the nature of clay and their initial responses may be incomplete and stereotypical (Coffey 2003). Characteristic of students' remarks on their experience was the comment, "ceramics is fun." Careful use of assessment skills and students' making constructive responses to peers' works can bring about students' more nuanced understanding of what they are achieving. To illustrate: two girls initially acted silly and would not focus. Questioning them elicited signs that their level of awareness of what they were experiencing was very low. With practice and trust, they became better at self-assessment. By inviting the program director and their parents to the assessment sessions, students also became more serious because I was challenging them to think in a professional way and in a novel setting. I also asked them to be the teacher and to plan the assessment sheet.

Embed problem documenting and measuring tools in everyday lessons. For students to understand problems, I asked them to document their learning. At the end of their second lesson that required students to make a coil pot, I asked them to "draw a picture of your pot and measure its thickness." The problem was even consistency and clay shrinkage. Initially, I told students to make their coil pot about half an inch thick—the width of their finger. Not all students accomplished this. I asked them to demonstrate their pot's clay consistency with calipers. "How do you use the calipers?" I asked. One student replied, "Start at bottom and pull up." As she started to pull, the calipers expanded. "What happened?" I asked. She remarked, "[The wall is] too uneven." "How will you improve it?" I inquired. "Start over; make it thicker," she answered. Students were enamored with such mechanical devices as the calipers. In the future, I will add an exercise in weighing clay pots at different stages to study water evaporation and clay shrinkage. These tasks will engage students further in the process of their everyday assessment.

Compare the first assignment with a later one. At the end of their second project, I asked each student to compare his or her first pot (pinch) to his or her second one (coil) using guiding questions (Arizona Department of Education 2003, Standard: PO1). I suggested these questions, "Discuss one thing that worked [successfully], one thing that didn't work [a problem], and one thing to do differently [a solution]" (Davies 2003, 17). I also reviewed my original criteria: to make the coils about one half-inch thick with even thickness to connect each coil using the process of slip (adding clay-like glue) and score (texturing the clay so parts grip together), and adding color or glaze to accent clay and not hide it. I videotaped these individual assessment episodes.

Finally, I used Davies's (2003) categories of confirmation, consolidation, and integration of new knowledge to encourage students to evaluate their learning. Students were asked to confirm briefly what they learned by explaining their problems and giving some evidence for their choices. They were partially able to consolidate, a way of reducing and combining, their answers. To get students to integrate new knowledge involved having them ask questions, compare processes, and form conclusions.

Coaxing them to elaborate on what they learned was difficult. Some students could see only one solution at first. Most students struggled with artisanship, especially even thickness, a term that they used. Technical qualities were the first things that they understood. The sidebar begins with suggestions for ways of eliciting student answers and categories of questions for teachers that I borrowed from (Davies 2003). Each category proceeds to specific questions that teachers might ask and examples of students' responses (see sidebar).

Conclusions and Implications

How can we help students learn to be self-critical? Educators should use everyday assessment of classroom learning because it provides students more feedback on their learning beyond mere measurement or rubric ranking. Teachers should provide opportunities

Questions, Suggestions for Eliciting Student Answers, and Sample Conversations

a. *Restate questions and concepts in different ways and prompt for quality answers.*

Mary Explain one thing that didn't work [a problem].
John: It's [the pinch pot] cracked and lopsided. I didn't reenforce it [at the bottom].
Mary: Discuss one thing to do differently [a solution].
John: Add more clay to bottom?
Mary: No, the clay will crack. What is another way to solve this problem?
John: Wet it [the clay] and slip and score. Redo it.
Mary: Discuss one thing that worked with your coil pot?
John: It came out right.
Mary: Please explain what you mean: consistent thickness, even rim?
John: Consistent thickness, flat at top, thicker at base.
Mary: Why thicker at the bottom?
Student: For balance.

b. *Use a variety of questions to assess and foster students' deeper thinking.* Instead of eliciting the so-called right answer, teachers can use questions to discover what concepts and reasons students use. Learning how we know is as important as what we know. I borrowed the kinds of questions that Minstrell and van Zee (2003) suggested when orchestrating student discussions about scientific ideas. Questions that ask students to identify and demonstrate basic physical and scientific properties and technical aspects of visual arts media are part of the Arizona Department of Education Arts Visual Art Standard 9 (2003, 1AV-E3).

An example of this emerged around kiln firing. Teachers need to enable students to accomplish the following goals, as the ensuing dialogs suggest:

• *Share their pre-understanding and reasoning*
Mary: How does a kiln work?
Student: Like a stove; something that heats clay to make it hard.
Mary: Tell me about how it works.
Students: I don't know. You fire it twice; heat things up.
Mary: What is the source of energy?
Students: Gas? Electricity?
Mary: Yes, those sources, and other kilns fire with wood, coal, and manure. This kiln has been firing slowly all night. Why?
Students: To reach a high temperature? Dissolve lots of water in it.
Mary: Yes, during the first hour, the water molecules evaporate.

• *Apply their knowledge*
Mary: The firing process is similar to boiling an egg. What happens when you boil it too fast?
Student: It cracks.

• *Clarify and elaborate their answers*
Mary: Elaborate on what you said. Be specific about what you observed.
Students: Clay changes into stone; the color changes; it expands.
Mary: No, clay actually shrinks because it's losing water.

• *Justify their answers*
Mary: How do you know that the clay has changed its stage?
Students: I can't make it [the pot] clay anymore.

• *Construct conclusions*
Mary: How do you know when the kiln is done firing?
Students: Poke it with a knife; color changes; use a thermometer?
Mary: Thermometer is close. Look into the kiln through the peephole and see the melted clay cone. Like a thermometer, the cone bends when the clay reaches the desired temperature and triggers the automatic pyrometric shutoff device that turns the kiln off.

c. *Generate new knowledge and understanding.* The next discussion accompanied a raku firing in the ceramics department on the next day. Students wanted to see how hot the kiln was; Rico, a ceramic technician, opened the door and students saw the red hot pots and felt the blast of hot air. They gained direct sensory knowledge through the

(*continues*)

for students to practice how to pre-assess and post-assess their own learning by interviewing each other, comparing their first assignment with a latter one, problem solving and reflecting collaboratively, evaluating their own artwork, documenting and measuring what they learn, and giving suggestions for improvement. In other words, teachers could supply opportunities for students to put into operation and enliven their learning by their observing, testing, and negotiating ideas in action (Nelson and Chandler 1999).

How can teacher preparation programs best enable teachers to become proficient in leading students to self-analysis when they are doing work? Higher education needs to help students and teachers develop higher-order reasoning skills in their everyday talk. Lemke (1990), who studied high school science discourse, insists that students practice using their subject-specific language to understand the structural concepts of the discipline. One suggestion is videotaping student critiques and other forms of reflective discourse, which can serve as student models of serious and playful evaluation (Sneider 2003). Another strategy is to post Web sites with developmental examples of artworks and knowledge—for example, images of clay figures and pots with which teachers and students would compare stages of their production (Stokrocki 2003). Boughton refers to these examples as benchmarks, "samples of student work selected by moderators to exemplify specific levels of achievement." The work samples clearly indicate the limits of performance within each level (2004, 596).

How should teachers and school systems find workable balance between this kind of project-based learning and fact/process learning? Schools need balance between assessments that demonstrate serious evidence of what is learned as well as how much is learned. Teachers can now report progress to parents developmentally—from pre- to the post-assessments with students' reflections. Schools should insist that the evidence—examples of pottery and related concepts from high to low

(*Continued*)

exchanges with Rico as they observed him and were invited to question him about his work. The goals were to

• *Prompt student questions*

Student: How do you fire it?
Rico: The initial [oxidation] firing is the same, but the oxygen is reduced when the pot is placed into [the can of] newspapers and covered with a lid.
Student: Where does the smoke go?
Rico: The vent takes out smoke and bad fumes. The burning newspaper makes carbon that goes into the clay and makes it gray or black. [He let them touch the pot as soon as it was cooled down with water.] Look in the kiln and tell me why the shelves are elevated off the bottom?
Student: So the clay won't burn on the bottom?
Rico: No, look at my gesture [swinging my arm around]. The oxygen has to?
Student: Circulate?
Rico: Yes, this is part of the physics of firing.
Student: Why do this [raku firing]?
Rico: To get a variety of metallic effects on the pot's surface.
Student: Can I drink out of it?
Rico: You would have to glaze it first.
Student: How long does it take to cool down?
Rico: It takes as long as it took to fire—usually overnight.
Student: When are you going to fire my pot?
Rico: As soon as it's completely dry, [and I'll know it is that dry when it is] not cool to the touch.

• *Find comparisons and exceptions*

Mary: In what ways are these firing events the same?
Student: The clay is pre-fired.
Mary: How is the process different?
Student: This [raku] process is shorter; it seems hotter; why didn't you fire your pot first?
Rico: Because it has been drying in the hot Arizona sun all day and if it explodes, I will destroy only my pot [exception] and not others. Also I can control the process.

• *Encourage debate and different reasoning*

Student: The clay is harder?
Rico: No, the clay is weaker because the temperature is lower. We make lots of mistakes. I'll throw this demonstration pot away.
Student: Don't throw the pot away; I want to keep it because of the beautiful colors.
Mary: Anyone want to argue with this reasoning?
No one was interested in debate at this point.
Mary: What relationships between firing processes do you see?
Student: Use different fuels. Why does it take so long?
Mary: Water evaporates and the clay turns into stone, a chemical change. The water and hydrogen [H_2O] changes its chemical formula. What is this process called?
Student: Vitification [sic] to heat like glass.

• *Form conclusions*

Mary: What can we conclude?
Students: Firing is a lot of work. Firing takes a long time. It's too hot and clay shrinks. Firing is an experiment—that doesn't always work. Glaze protects or beautifies clay. So it will hold water.
Mary: Yes, some potters glaze fire several times for different effects.

d. *Involve students in the mechanics of firing.* Initially, mechanics include loading the kiln, watching the melting cones for firing time, and sensing the heat and smoke. Student learning begins to evolve from sensory perception to conception and from a fixed point to a more exploratory but selective activity. Students may initially maintain rigid ideas about art and science and how systems work. Later, students notice firing differences in various kilns, fuels, temperatures, and processes beginning with simple cooking metaphors (like boiling an egg) and continuing with the process of firing a pot

(*continues*)

thinking with reference to state and national standards. Assessment must be managed and interpreted by teachers, include students' input, and be assessed and discussed immediately.

What are some national implications for large-scale assessment? Large-scale assessment, both national and state-based, needs to provide good example instructional activities with related assessment devices that lead to deep understanding of the arts and inquiry skills. These examples need to be released, possibly on the Internet. The problem is that national assessments "emphasize what students should learn, [but] they do not describe how students learn in ways that are maximally useful for guiding instruction and assessment" (Pellegrino, Chudowsky, and Glaser 2001, 256). Assessors need to provide examples of how students got there—how they solved the problem. My sample study shows different problems and students' solutions. Large-scale tests need to include extra notations because students fail to understand the task. Take one example of a notation for students. Important considerations as you examine your pot are (*a*) is the bottom too thin or thick, (*b*) is the weight of the pot too heavy or light, and (*c*) how does the glaze enhance the clay or detract from it?

Large-scale assessment needs to incorporate double-digit rubrics—a score and a reason for the score—and identify the most frequent problems in students' thinking and the different reasons (Shepard 2003). Most rubrics are so generic that they fail to identify the diverse reasons why students did not succeed. Typical examples are confusion over the wording of the test and students answering only part of the assignment. Test makers must inform students and teachers what parts were left out and why. For example, if the test asks a student to determine the texture of something, many students think that texture automatically means some kind of roughness and forget that smooth is a texture. These reasons evolve with practicing, pilot testing, and teacher assessment conversations.

States must involve teachers in assessment development and scoring to determine what students are actually learning. Because I was the participating teacher, I was able to adjust my teaching, assessments, and rubrics according to the feedback that students gave me. Teachers need to write their own answers to the questions that they give students before developing criteria and rubrics to catch the errors in their own thinking and also see the dissonance between what they teach and what students actually learn (Shepard 2003, 42). Teachers need materials that model teaching for understanding—with extended instructional activities, formative assessment tasks, scoring rubrics, and built-in summative assessments. Long-range testing needs qualitative studies of how students (of different levels, ethnic groups, or abilities) react to these national assessments that provide this additional information. The problem is that states and schools face layers of assessment demands and need practical and accessible examples of how to improve learning.

(*Continued*)

in an oven, in a pit or a metal can, in an oxidation kiln, and in a raku kiln. Students' ideas focus more on what they learn from experiments and mistakes that demand hard work or solutions. Parents should also be invited to participate in or witness the ritual of firing.

e. *Provide diagnostic feedback.* At the end of the course, students and their parents received diagnostic feedback, consisting of commendations and recommendations based on questionnaire results to ascertain if students gained knowledge and understanding in the course (Sneider 2003). Diagnostic feedback should reinforce state standards, such as "interdisciplinary learning experiences integrate knowledge, skills, and methods of inquiry from several subject areas." For example, on the open-ended post-questionnaires, all eleven students included ceramics as the study of clay, glazes, rocks, and firing. They also reported new ideas about science, such as "asking questions, making hypotheses, how to find knowledge, and how everything works." Students conveyed understanding that demonstrates professional knowledge according to State Standard #8 (Arizona Department of Education 2003). I also gave parents a list of important concepts, future things to research, or related resources, such as visiting the local science museum, mineral museum, and the Ceramics Research Center.[1]

Note

1. Teachers can also develop conceptual lists and developmental progress maps for students based on levels of success: sensing, describing, representing, comparing, predicting, integrating, and concluding (Wilson and Scalise 2003).

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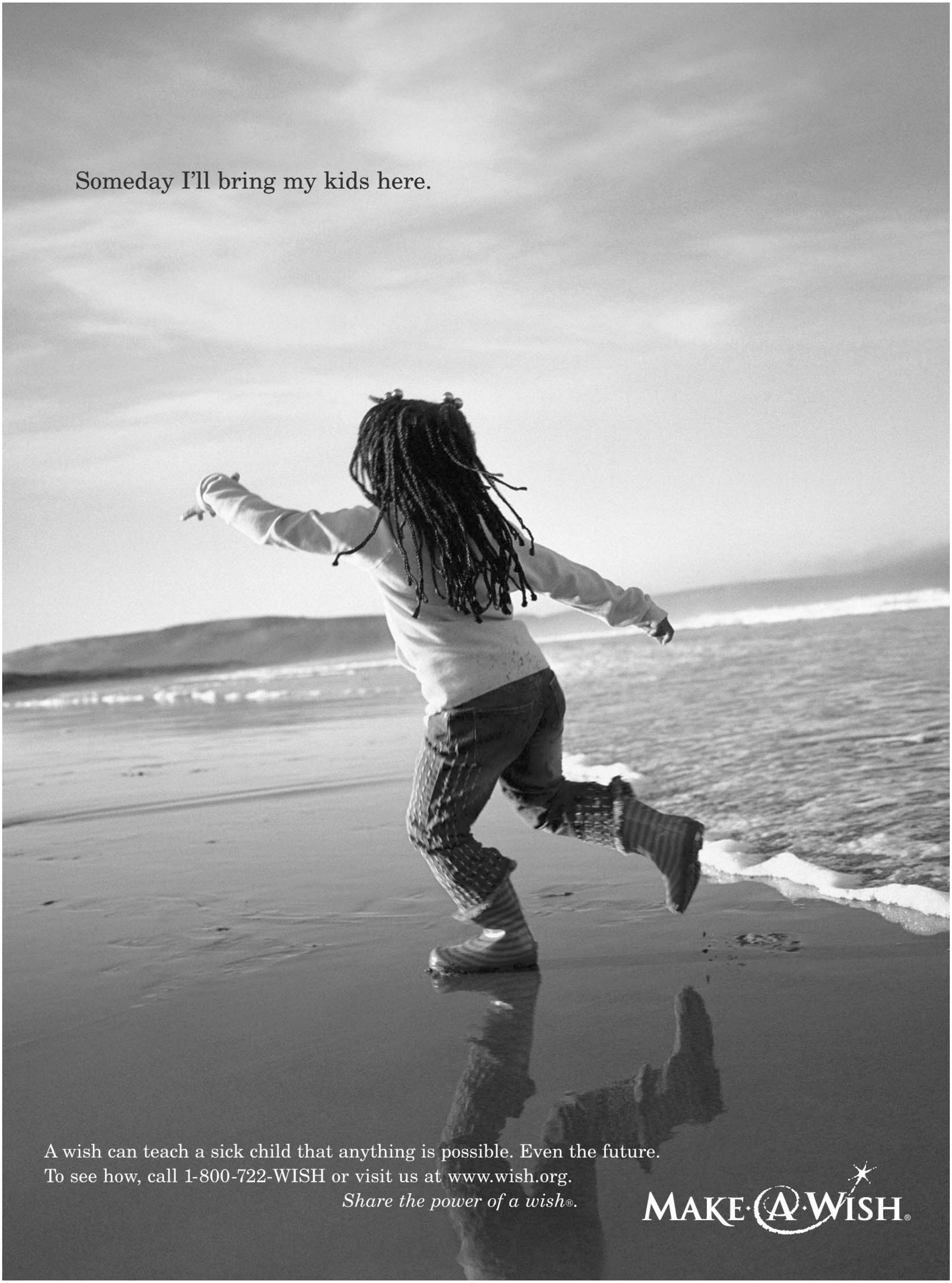

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