World Vision Ignite



Clean water access: A case study

A problem-solving challenge in engineering

TEACHER'S GUIDE

OBJECTIVE: This case study will push students to engage deeply with sector-based development work by understanding context and personal stories in a real-world scenario. Students will apply their research, analytical, and engineering skills to propose a solution to the problem in a specific community. Students will then compare their proposals with actual development solutions implemented by experts in the field.

Determine a due date for submissions and communicate at the start of the project.



STEP 1

IDENTIFY AND ADDRESS THE PROBLEM

The end goal—students will tackle this real, modern-day challenge:

Families in the village of Kulmado in the Dosso Region of Niger lack access to clean water. What type of water system would you propose as the sustainable clean water access solution in this community?

Key concepts students must identify before moving to Step 2:

- Define "sustainable."
- Define "access to clean water."
- Locate region on a map.

Helpful background knowledge for educators

Niger is one of the world's poorest countries. According to the World Bank, over 40% of Niger's population lives on less than $2.15 a day,[1] while 54% of all Nigerians lack access to clean water.[2] Most people rely on farming for a living, so water shortages create crises. In a land known for its arid, desert-like conditions and frequent droughts, life is a constant struggle for many.

[1] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[2] UNICEF, https://open.unicef.org/sites/transparency/files/2020-06/Niger-TP6-2018.pdf

STEP 2

LEARN ABOUT THE REGION

Encourage students to learn about the region so they can understand the need for clean water. Note: It will likely be easier for students to gather information about the Dosso Region and Niger in general rather than the village of Kulmado.

Task each student with creating a brochure of Niger that includes details about the following aspects of the region:

- Geography/location
- Climate/weather
- Populations/ethnic groups
- Natural resources
- Religion
- Political/government structure
- Livelihoods/economy
- Health issues/mortality rates
- Current events
- Humanitarian organizations currently providing support in the region

Helpful background knowledge for educators

Information about Niger: landlocked; one of the hottest countries in the world; northern four-fifths is desert, southern one-fifth is savanna, suitable for livestock and limited agriculture

Geography/location: Located in West Africa southeast of Algeria, Niger is a landlocked nation slightly less than twice the size of Texas. Situated about 80 miles southeast of Niamey, the capital of Niger, Dosso is one of eight regions in Niger and comprises an area of just under 12,000 square miles in the panhandle part of the country. Kulmado is a small village located within Dosso.

Climate/weather: Niger is one of the hottest countries in the world. The World Bank reports that temperatures here are rising 1.5 times faster than in other places in the world. Primarily a desert, the climate is mostly hot, dry, dusty, and tropical in the extreme south. Only one-fifth of the entire country is savanna, suitable for livestock and limited agriculture, yet 35% of all land, including areas where it is difficult to farm, is used for agriculture. Very little land is irrigated, which makes farming difficult—especially in a place where droughts are common.[3]

[3] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/

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Population/ethnic groups:

Niger: 27,202,843 (as of 2023)[4]

Kulmado: 3,999[5] *NOTE: This village population will be too difficult for students to find on their own, so please share this information early on as students begin their research.*

In Niger, more than 40 percent of the population lives below the international poverty line.[6]

Ethnic groups (as of 2006): Hausa (53%); Zarma/Songhai (21 %); Tuareg (11%); Fulani/Peuhl (6.5%); Kanuri (5%); and less than 1% Gurma, Arab, Tubu, and other.[7]

Languages: Hausa, Zarma, French (official), Fufulde, Tamashek, Kanuri, Gurmancema, Tagdal.[8]

Natural resources:

Agricultural products: Millet, cowpeas, onions, milk, groundnuts, sugarcane, cabbages, cassava, and potatoes.[9]

Industries: Uranium mining, petroleum, cement, brick, soap, textiles, food processing, chemicals, and slaughterhouses.[10]

Religions:

Muslim (95%); ethnic religionist (4%); and less than 1% Christian, agnostic, and other.[11]

Political/government structure:

Niger achieved independence from France in 1960 and experienced single-party or military rule until 1991, when political pressure forced leaders to allow multiparty elections. A series of coups followed in 1996, 1999, and 2010. From 2011 on, democratic elections were held and two presidents in a row were elected. But in 2023, the National Council for the Safeguard of the Homeland, a military junta, took control of Niger's government, dissolved all government institutions and the country's constitution, and now rules by decree.[12]

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[4] World Bank, https://data.worldbank.org/country/niger
[5] Information provided by World Vision Staff member, Sidney Shea, MPH, WASH Program Manager
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[6] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[7] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[8] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[9] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[10] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[11] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[12] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/

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Livelihoods/economy:

According to the World Bank, Niger has a poorly diversified economy, dependent on agriculture for 41% of its GDP.[13] The economy of the surrounding region is based on subsistence farming and livestock breeding. The dependence of Nigerians on the land is exacerbated by frequent extended droughts, reduced food production that can't keep up with the growing population, and rising food prices. The government is trying to increase its oil production and mining to offset the shrinking agricultural production, but the country still ranks fourth from the bottom on the Human Development Index—an index that considers the health, education, income, and living conditions in a given country.[14]

Health issues/mortality rates:

Infant mortality: 64 deaths per 1,000 live births (2024).[15] Niger has the highest total fertility rate (TFR) of any country in the world, averaging close to 7 children per woman in 2022.[16] Gender inequality, including a lack of educational opportunities for women, child marriage, and early childbirth, also contributes to high population growth. In Niger the average age of first-time mothers is under 19. And when mothers are this young, both they and their babies face an increased risk of complications and death. Additionally, internal conflict, high food prices, and floods have led to widespread food insecurity. In 2023, UNOCHA reported 4.3 million people, or 17% of the population, requiring humanitarian assistance in Niger, compared to 3.7 million in 2022.[17]

Current events:

Niger has endured significant political and social crises along with extreme weather challenges recently. After an overthrown presidential election in 2023, various sanctions complicated an already suffering economy. Niger is experiencing a steep increase to the cost of living as well as an increased difficulty in accessing essential goods and services. These challenges are leading to complications with population displacement, school closures, agricultural barriers, and refugee crises. Violence and unrest are rampant. Additionally, Niger deals with security issues at its borders due to conflict and unrest in the neighboring countries of Libya, Mali, and Nigeria.[18]

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[13] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[14] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[15] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[16] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/
[17] World Bank: https://www.worldbank.org/en/country/niger/overview
[18] CIA The World Factbook, https://www.cia.gov/the-world-factbook/countries/niger/

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Humanitarian organizations currently providing support in the region:

One example: World Vision

World Vision is the leading nongovernmental provider of clean water in the developing world. In Niger, World Vision is focused on creating sustainable water, sanitation, and hygiene (WASH) programs. Their staff, mostly local to Niger, work closely with the national government's Ministry of Water Resources and Sanitation, the private sector, and community groups that they organize and train to manage and maintain their water systems. In 2019, World Vision helped 101,100 people in Niger gain clean drinking water access.[19]

[19] World Vision News, https://www.worldvision.org/clean-water-news-stories/10-worst-countries-access-clean-water#:~:text=Niger%3A%2054%25%20lack%20access%20to%20clean%20water&text=Over%2040%25%20of%20Niger's%20population,on%20creating%20sustainable%20WASH%20programs.

Make it personal

Assign students to read an article about one family in Kulmado who lacks access to clean water and the impact it has had on their lives: "Two sisters: Two worlds."

Note: For students to answer the next set of questions under "Make connections," they will need to have read the preceding article, so make sure this step isn't overlooked.

Make connections

Ask students to explain how access to clean water relates to each of the following areas:

- Health and mortality rates
- Learning environments and education
- Gender equality
- Food insecurity and hunger
- Economics and livelihoods

Helpful background knowledge for educators

Around the world, 703 million people lack access to clean water,[20] yet clean water access changes everything and is the foundation from which communities can lift themselves out of poverty.

Access to clean water:

World Vision: When reporting the number of people reached with clean water, World Vision includes only those who walk 30 minutes or less roundtrip to access clean water.

The government of Niger's standard is one well with a hand pump to serve 250 people and one mechanized piped-water system tap stand to serve up to 500 people. In schools and health centers, access is defined as having access to an improved drinking water source on premises.[21]

Clean water and health:

Nearly 4,000 people, more than 1,000 of whom are children under 5, die every day from diseases related to lack of safe water, sanitation, and hygiene.[22] Additionally, The World Health Organization estimates that the lives of 1 million mothers and newborns can be saved every year by improving hygiene in health centers.

Clean water and education:

Globally, 546 million children attend schools that have no water access, and an even greater number of children go to schools that lack basic hygiene and sanitation facilities.[23] Only 22.7% of schools in Niger have access to drinking water.[24] Additionally, many children miss school because they are needed at home to collect water. As a result, they fail to benefit from the economic opportunities of education, and the cycle of poverty continues.

Clean water and gender equality:

The burden of water collection around the world disproportionately impacts women and girls, who spend an estimated 200 million hours hauling water every day.[25] On average, they walk 6 kilometers a day to haul 44 pounds of water. It's a full-time, physically demanding role that prevents women from pursuing an income and helping their families overcome poverty.

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[20] WHO/UNICEF Joint Monitoring Programme, Progress on household drinking water, sanitation and hygiene 2000-2022, July 2023
[21] Information from charity: water: Niger/ Country Program Profile NE.WVI.2H.23.538_v1_08.11.23
[22] WHO/UNICEF Joint Monitoring Programme, Progress on household drinking water, sanitation and hygiene, June 2022
[23] WHO/UNICEF Joint Monitoring Programme, https://data.unicef.org/resources/jmp-wash-in-schools-2022/#:~:text=Key%20findings,services%2C%20impacting%20539%20million%20children.
[24] UNICEF, https://www.unicef.org/niger/water-sanitation-and-hygiene
[25] UNICEF, https://www.unicef.org/press-releases/unicef-collecting-water-often-colossal-waste-time-women-and-girls



STEP 3

RESEARCH

Answer the following questions:

Direct students to research different solutions for providing clean water in places where there is currently limited or no access and ask them to address the following:

- Based on what you've learned about this region, what is the best way to create sustainable access to clean water for this community—would it be providing filters? A well? Irrigation from a nearby river? A combination of methods? Explain your reasoning.
- Which groups of people do you need to consult and collaborate with prior to making final decisions about how to bring clean water access to the community?
- Who are some of the major providers of clean water access around the world who can provide funding or other forms of support? (World Vision is one, but who else?)
- What types of engineering tests or feasibility surveys need to be conducted before you can determine the best approach to creating access to clean water?
- In addition to proposing a primary main water source, where would you place additional water points to help improve the well-being of families in communities? (See "Make connections" section as a point of reference and be sure to consider all the aspects of life mentioned.)
- Estimate the costs involved if your strategy were implemented, along with the number of people that will be reached with clean water access and the specific resources needed for construction.
- What is the best approach to implementing these resources and equipping community members with clean water access?
- What are potential ways to partner with the community and other organizations to help plan, build, and maintain the water source?
- How would you make sure your proposed solution would be safe and sustainable (ensuring the water access continues to be a source of clean water) in the future?

Helpful background knowledge for educators[26]

Options for providing clean water access:

- Wells with hand pumps can serve communities of at least 250 people.
- Limited mechanized water systems can serve communities with populations between 500 and 1,000.
- Mechanized piped-water systems (single village) can serve communities with a population between 1,500 and 3,000 people.
- Mechanized piped-water systems can serve multiple communities totaling 5,000 to 8,000 people.
- Examples of other options include rainwater harvesting and filters.

(Note: For communities with less than 250 people, a hand pump can be provided, if analysis shows that there are enough users to support repair and maintenance. If a community is not far from an existing mechanized water system, often they will seek to connect it to that existing system instead through a system extension.)

Collaborators needed:

Water point site identification and selection is conducted in collaboration with the communities, as well as local administrative and technical authorities at either the community or district level. This ensures compliance with the community and supports their ultimate ownership of the infrastructure.

Examples of major providers of clean water access in Niger:

World Vision, Conrad N. Hilton Foundation, P&G, charity: water, United Nations funding (U.N. World Food Programme), Gates Foundation, and more.

Initial assessment:

A community assessment is conducted, determining community population, capacity for financial contributions to sustain water points, current water points, borehole capacity, and water sources.

Tests:

Site selection consists of considering local government recommendations, identifying existing boreholes, and ensure the willingness of the communities to contribute toward construction, repair, and maintenance. Once a community is selected, World Vision conducts a more in-depth analysis, performing feasibility studies (land surveys, making sure the potential water source can yield at least five cubic meters per hour, etc.), environmental studies, and hydrogeological studies

[26] Information provided from a report on a joint project between World Vision and charity: water: Niger/ Country Program Profile NE.WVI.2H.23.538_v1_08.11.23

to ensure the best solution is the one that gets implemented. Once a borehole is drilled, a pumping test is conducted. Once water is accessed, tests are completed to determine water treatment needs, such as filtration, chlorination, desalination, etc.

Water points needed:

Ideally water points will be placed in or near schools, in health clinics, and in central locations closer to households and on household premises when possible. Additionally, a system is needed that can support water needs for livestock and small-scale irrigation.

Estimated costs:

- ***Mechanized piped-water system (single community):*** approximately $86,000
- ***Mechanized piped-water system (multiple communities):*** approximately $150,000

Resources needed:

Examples of equipment needed to make clean water access available could include large drill rigs, trailer-mounted drill rigs, compressors, supporting vehicles that can handle rough terrain, geophysical equipment, pipe and fittings, pumps, and solar panels.

Safety and sustainability:

When a community is selected, community members complete a commitment form, stating their commitment to accepting and maintaining all provisions, including the agreed-upon water fees that take into consideration the number of households and people that cannot afford to pay, including elderly people and child-headed households. These fees, along with community-appointed oversight committee members, help ensure that the clean water source remains safe and sustainable. Additionally, community members are selected and trained to serve on a committee to oversee operations, oversight, and maintenance.



STEP 4

STUDENT PRESENTATIONS

Encourage students to choose how they present their solution, whether that is through creating a 3D model, a PowerPoint with images, or a five-minute video. They must include the following in their presentations:

- Their strategies and why they chose this solution.
- Materials/resources needed and the proposed costs.
- An explanation about how this approach to providing clean water access can impact the well-being of families in the community.
- An explanation about how their solution will be safe and sustainable.

How students should submit their presentations:

- Upload all documents/presentations in PDF format to a storage drive (Google Drive, Dropbox, etc.).
- Upload any videos to YouTube/Vimeo (unlisted setting).
- Email links of all elements of the project to casestudy@worldvision.org. They need to include the name of their school, teacher/email, and individual / group members in the body of the email.



STEP 5

EVALUATION

Once students have submitted their strategies to World Vision, you will receive details about the actual solution World Vision experts chose and implemented in the village of Kulmado.

After reviewing World Vision's solution with your students, challenge them to compare their solutions with the one implemented by World Vision experts by answering these questions:

- How did your findings align with those of World Vision's engineers?
- In what ways did your proposed solution differ from World Vision's?
- What surprises you about the strategy World Vision employed?
- In what ways did your solution align with World Vision's?
- What considerations did you leave out, or what mistakes did you make?
- How did World Vision make this project sustainable?
- How does World Vision's solution show that partnerships are important?

Example:

Read the following to your students to share how World Vision's work with communities to provide clean water access is impacting every aspect of life for people in Niger, including **education**:

World Vision plans to provide basic sanitation in 200 schools and hygiene promotion and supplies in 500 schools in Niger over the next five years. World Vision promotes hygiene in schools by establishing school WASH clubs and training students to lead peer-to-peer educational activities such as hygiene and sanitation campaigns. School WASH clubs play an essential role in sustaining school water points, latrines, and handwashing facilities. Children who participate in WASH clubs are empowered as leaders and effective change agents within their schools, families, and communities. World Vision also ensures that WASH clubs include girls and empowers them in WASH decision-making.

World Vision also uses the WASH UP! approach to ensure comprehensive programming in schools, combining access to inclusive facilities and capacity building of schoolchildren and workers. WASH UP! is a partnership between World Vision and Sesame Workshop, the nonprofit organization behind Sesame Street. The WASH UP! program teaches children to learn, practice, and share safe sanitation and hygiene lessons.

Dig deeper:

Ask students to reflect on their research and answer the following questions:

- What aspects of this research have been the most meaningful to you?
- How did this research open your eyes to the realities of the world?



STEP 6

GO THE EXTRA MILE!

Add impact by joining World Vision in helping people gain access to clean water.

Encourage your students to put what they've learned into action:

- Learn more about World Vision's work to equip vulnerable communities with clean water access.
- Organize/get involved in a fundraiser using this fundraising tool.
- Explore other student-led projects that can inspire you to make a difference.
- Look through World Vision's Gift Catalog to help fund access to clean water.
- Use your voice to speak up for children and families in need around the world. Learn more about becoming an advocate through World Vision Advocacy.

Additional helpful links:

https://www.cia.gov/the-world-factbook/countries/niger/

https://www.worldvision.org/our-work/country-profiles/niger

https://storymaps.arcgis.com/stories/a73563c0d11b433fa35e0bd10a546087

https://www.worldvision.org/category/clean-water-news-stories

https://www.worldvision.org/our-work/clean-water

https://www.unicef.org/niger/stories/how-access-water-changed-life-five-villages-nigers-tahoua-region

https://www.afro.who.int/health-topics/water

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