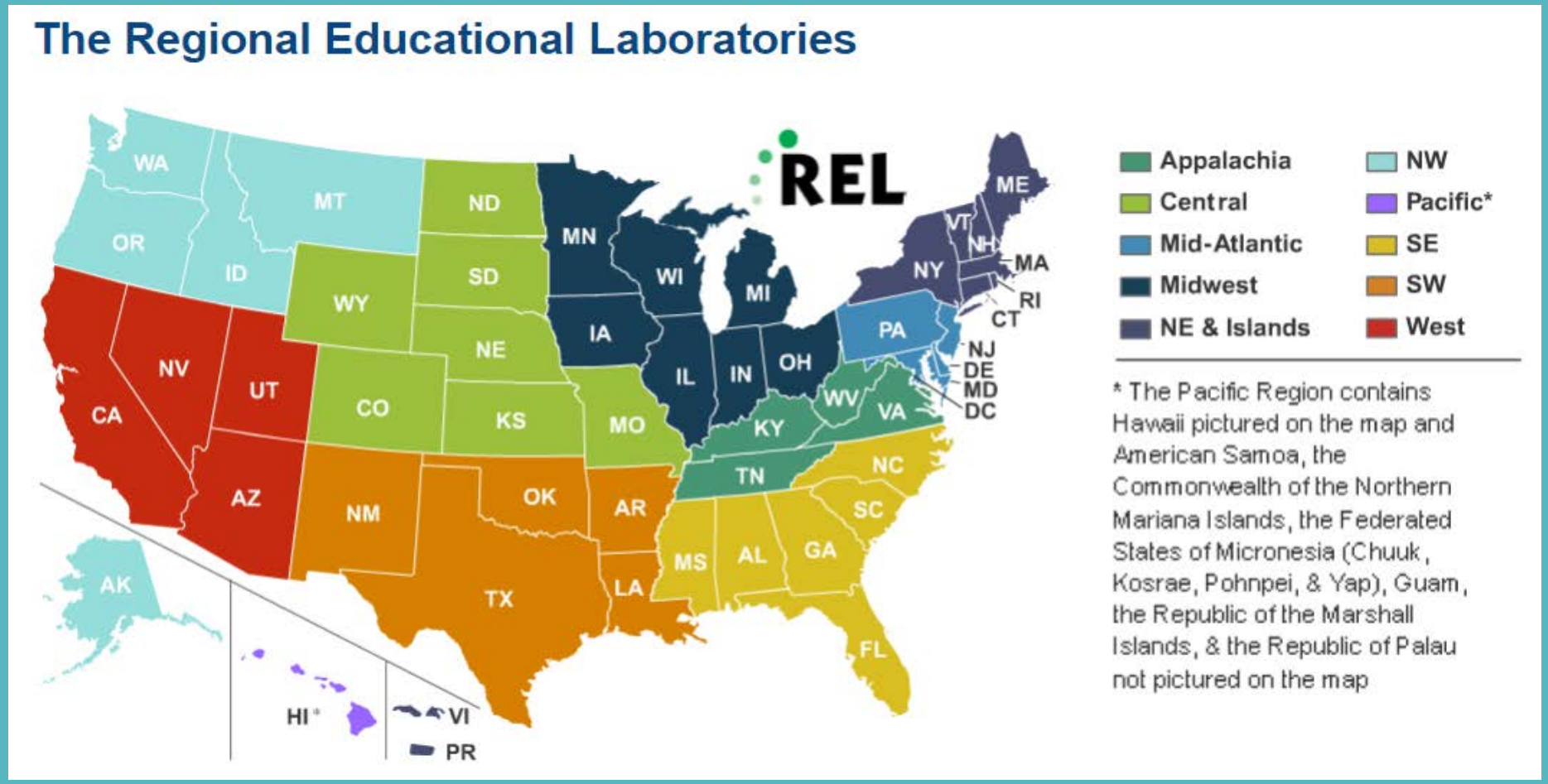
Codesigning an Evaluation of Virtual Virginia Outcomes, Implementation, and Costs

Jessica Mislevy, Jennifer Piver-Renna, and Jaunelle Pratt-Williams

NCES STATS-DC Conference, Washington, DC

July 26, 2019

REL APPALACHIA
Regional Educational Laboratory At SRI International



The 10 Regional Educational Laboratories (RELs) work in partnership with stakeholders to conduct applied research and training.

The REL mission is to support a more evidence-based education system.

Meet your presenters

Jessica Mislevy, REL Appalachia @ SRI International (REL AP)

Jennifer Piver-Renna, Virginia Department of Education (VDOE)

Jaunelle Pratt-Williams, REL Appalachia @ SRI International

Agenda

Time	Topic
10:15–10:20 a.m.	Welcome, introductions, and agenda review
10:20–10:30 a.m.	Background and state motivations for studying virtual learning initiatives
10:30–10:35 a.m.	Overview of VDOE/REL AP partnership and project components
10:35–10:45 a.m.	Analysis of student outcomes in Virtual Virginia courses
10:45–10:55 a.m.	Cost feasibility analysis for virtual learning programs
10:55–11:05 a.m.	Enhanced collection of program implementation data via surveys and other methods
11:05–11:15 a.m.	Reflections, next steps, and discussion

Background and state motivations for studying virtual learning initiatives

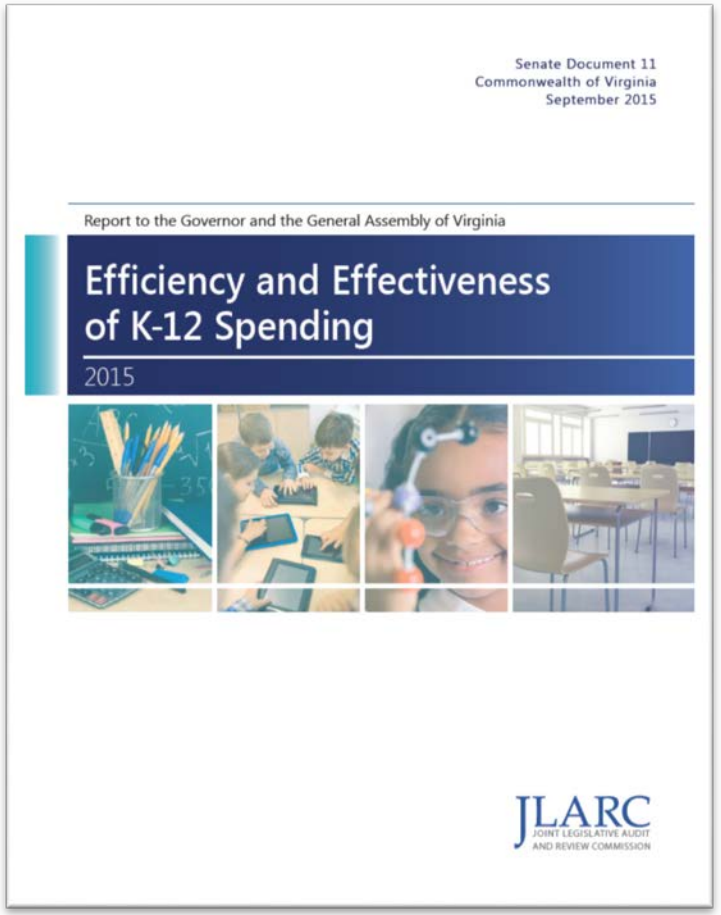
Virtual Virginia

The Virginia Department of Education's Virtual Virginia (VVA) program delivers over 70 online courses and digital content to more than 10,000 middle and high school students a year.

- VVA offers online Advanced Placement, world language, elective, and core academic courses that can be scheduled flexibly throughout the day.
- VVA instructors are full-time or adjunct, Virginia-licensed, highly qualified, and have experience in distance learning.
- VVA offers a supplemental enrollment model and, as of 2014/15, a full-time enrollment model with all the core academic courses and electives required to earn a high school diploma.
  - Supplemental: enrollment in 4 or fewer VVA courses
  - Full-time: enrollment in 5 or more VVA courses

Background

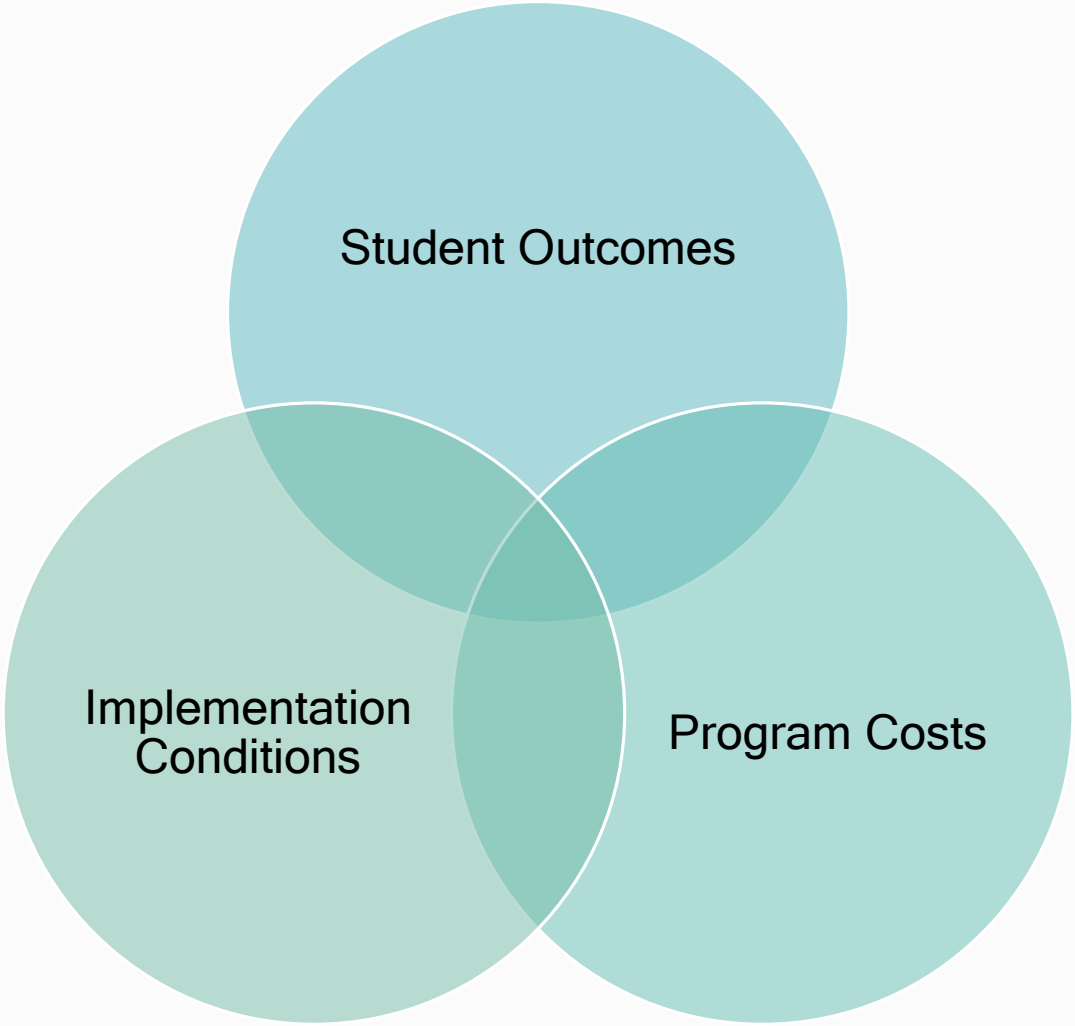
- The General Assembly established the Virginia Learning Advisory Committee to conduct strategic planning to expand blended and online learning opportunities in Virginia's public schools.
- The Virginia Joint Legislative Audit and Review Commission (JLARC) recommended that the state conduct **ongoing analysis of student outcomes in online programs compared with place-based schools**.
- This information is of particular policy relevance as the state considers expanding its offerings into fully online virtual schools.



Overview of VDOE/REL AP partnership and project components

REL AP's support activities

- Providing VDOE with in-depth coaching and consultation to codesign a comprehensive plan to evaluate the **implementation**, **outcomes**, and **costs** of Virtual Virginia (VVA)
- Conducting a secondary analysis to compare the academic achievement of students in VVA courses with that of their peers in face-to-face courses



Analysis of student outcomes in Virtual Virginia courses

Selection of outcomes: Academic achievement

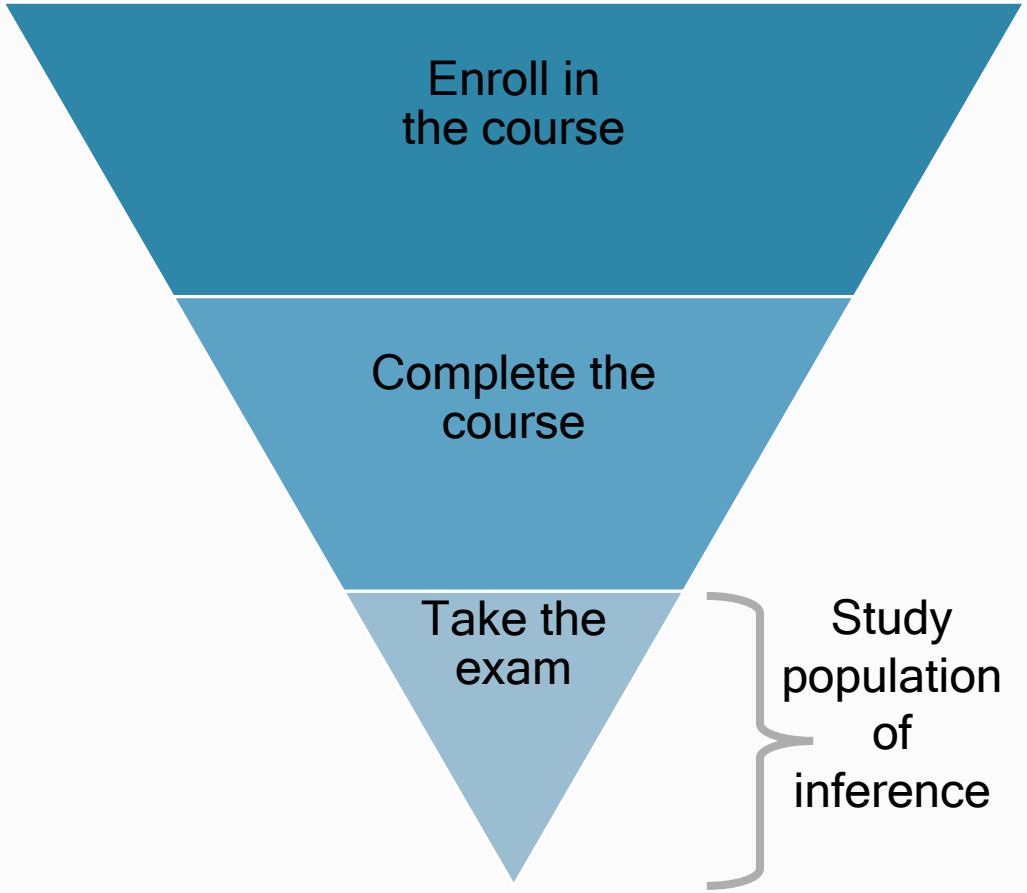
VDOE and REL AP staff identified performance on **available standardized exams** as the target study outcome.

- College Board's **Advanced Placement (AP) exams**
- Virginia's **Standards of Learning (SOL) end-of-course (EOC) exams**

Several other possible academic achievement outcomes were explored and excluded because the data were:

- Not collected (e.g., credit attainment).
- Not available within the study time frame (e.g., subsequent course enrollment).
- Not measured consistently across schools/divisions or course format (e.g., course grades, incompletes, withdrawals).

Research question and population of inference

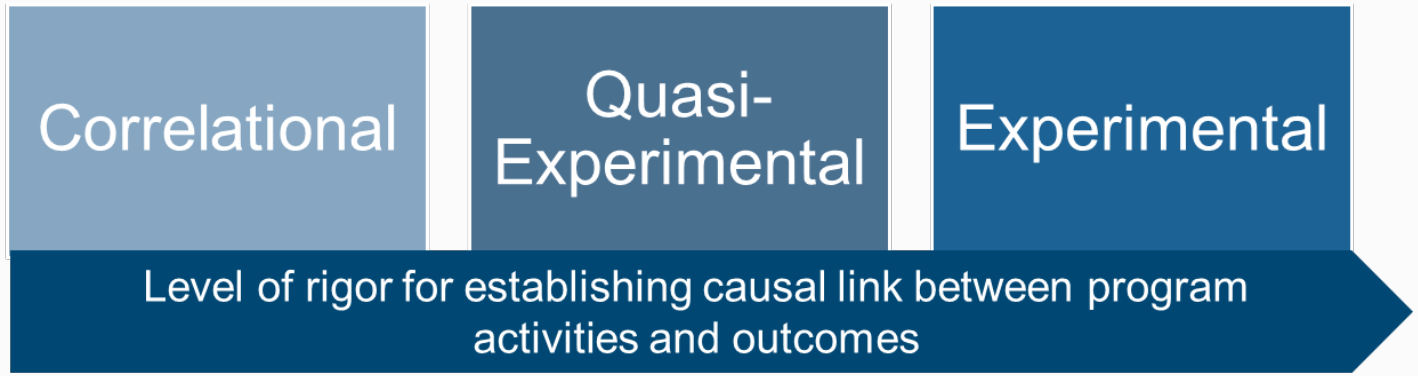


How do students who enroll in and complete online courses through VVA perform on standardized EOC exams compared with similar students who complete the same courses face to face?

Study design considerations

REL AP staff discussed the following approaches with VDOE:

- Experimental: Not possible
  - Study relies on existing data, and selection into online courses was not randomized.
- Quasi-experimental design: Not selected
  - Establishing baseline equivalency in virtual courses (e.g., students taking courses not offered in their schools) and unknown process of selection into VVA courses were challenges.
- Correlational: **Selected**



Data sources and sample

- VDOE provided REL AP with de-identified student-level administrative records from the Virginia Longitudinal Data System (VLDS).
- The sample consisted of **all Virginia public school students** in **grades 8–12** in courses with EOC **SOL or AP exams** who took the exam during the **2015/16 and 2016/17 school years**.
- Researchers used the student's school code from the VLDS to link to the **locale classification** and **percent rural** from the NCES Common Core of Data and the United States Census, respectively.

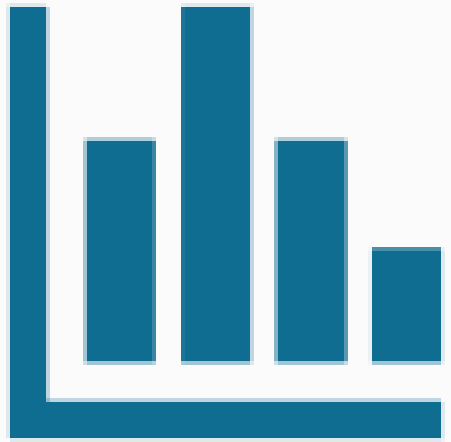
Statistical controls

- Students in online and face-to-face courses are expected to vary on student and school characteristics in ways that may affect outcomes, such as their prior academic achievement.
- Statistical adjustments can reduce **observable** differences between groups.
- Researchers controlled for the following variables in analyses:

Student demographics	Student prior achievement	School characteristics
Grade level, age, gender, race, gifted status, English learner, disability status, economically disadvantaged status	Students' scores on the grade 8 reading SOL for English language arts, the grade 8 science SOL for science, and the math SOL the student took when he/she was in grade 8 (such as grade 8 math, algebra I EOC)	Percentage of the population in the region of the school that is designated as rural

Analysis overview

- **Descriptive statistics** assess the comparability of the sample of students in VVA courses and face-to-face courses.
- **Regression analyses with statistical controls** compare the outcomes of students in VVA courses with outcomes of students in the same face-to-face courses, controlling for observable characteristics.
  - Outcome as a continuous measure (exam score)
  - Outcome as a dichotomous measure (passing score)



Additional strategies used to increase rigor

Analytical challenge	Strategy used to increase the study rigor
The number of students in VVA online courses was small.	Researchers aggregated data across the two school years and pooled exam scores across courses in the same subject area to increase the available sample of online students.
EOC exams were not scored on the same scale across courses.	Researchers used an accepted transformation to put the different tests on a comparable metric or scale known as a z-score.
Some students had missing values for one or more statistical controls.	Researchers used logical imputation and multiple imputation to replace missing data with substituted data based on other known information about the student. Researchers did not impute missing outcome scores because the study sample was limited to students with EOC exam scores.
Students were clustered within schools.	Researchers adjusted the standard errors used in statistical significance testing to account for the loss of precision due to the fact that students tend to be more similar within schools than across schools.

Key limitations of the study

- Correlational (noncausal)
- Narrow population of inference (subset of VVA courses, students who complete the course and take the EOC exam)
- Small sample sizes for VVA online courses
- Covariate adjustments limited to available, observable factors
- Course rigor and instruction quality not addressed
- Overall analysis may mask important course and subgroup differences
- Questionable applicability/generalizability to other online settings beyond VVA

Looking to the future

- Opportunities to expand on these initial efforts with alternative approaches
- Changes in design and analysis can:
  - Improve and refine estimates
  - Increase confidence in findings
  - Inform understanding of how subgroups of interest may be similar or different
  - Reveal how student performance may vary based on different outcome measures

Potential dimensions to explore

- **Level of evidence**: studies designed to support causal inferences about VVA's impact (e.g., experimental or quasi-experimental studies)
- **Population of inference**: other outcomes and/or study designs that could support inferences beyond the population of EOC exam takers
- **Target outcomes**: other short-, mid-, and/or long-term outcomes (e.g., access, subsequent course-taking patterns and performance, staying on track academically and graduating, enrolling in college)
- **Course and subgroup variation**: relationship between online course taking and performance may differ by course and/or for specific subgroups of students
- **Mediating factors**: particular use models and implementation supports may contribute to persistence and achievement

Cost feasibility analysis for virtual learning programs

What is a cost analysis?

- A cost analysis is an economic evaluation of resources.
- There are four types of cost analysis.
  1. Cost-feasibility
  2. Cost-effectiveness
  3. Cost-benefit (also referred to as benefit-cost)
  4. Cost-utility
- Each type of analysis uses the same initial approach to assess the resource costs but answers different questions.
- This initial approach entails calculating the cost of resources, personnel, facilities, materials, and any other items necessary for implementation using the **ingredients method**.

Questions cost analysis can answer

Cost analysis type	Cost questions this type of analysis answers
Cost-feasibility	Are there adequate resources to implement a new policy or program or scale up an existing one?
Cost-effectiveness	Which of several policies or programs produce the desired outcome for the lowest cost? or Which maximizes the desired outcome for a given cost?
Cost-benefit	Are the economic benefits of a policy or program greater than the costs?
Cost-utility	Is the usefulness of a policy or program valued by stakeholders compared with the costs?

The ingredients method

A detailed list of all the resources needed to initiate and carry out a program or intervention

Let’s use a brownies recipe as an example …

Levin, H. M., McEwan, P. J., Belfield, C. R., Bowden, A. B., & Shand, R. D. (2017). Economic evaluation in education: Cost-effectiveness and benefit-cost analysis (3rd ed.). Thousand Oaks, CA: Sage.

Costing with the ingredients method

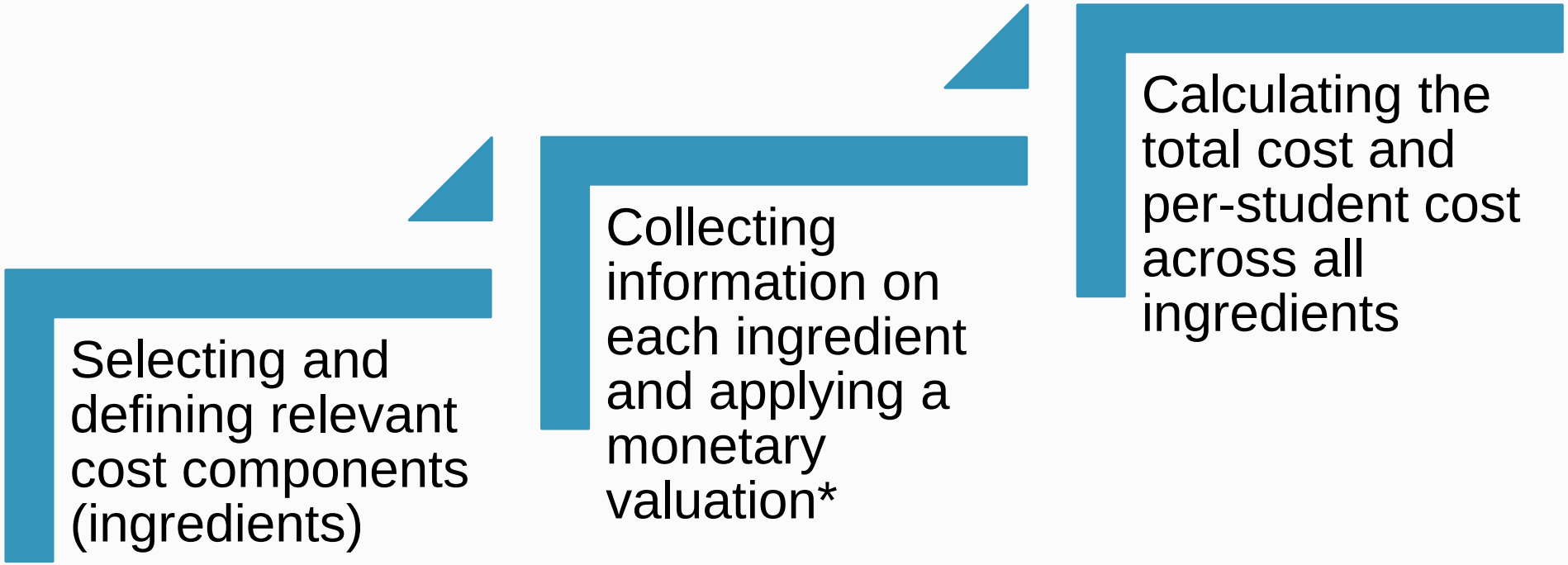
- Itemizes resources needed for program replication
- Makes an effort to understand value of resources regardless of price
- Is inclusive of all payers (or is explicit about particular purchasers)
- Relies on budgets as one but not the only data source
- Provides techniques for spreading out cost of investments over the life of the program

Example cost considerations for online programs

Management	• Administrative personnel, supplies, facilities, postage, marketing, and strategic planning
Instruction	• Instructional personnel, professional development, instructional supplies and materials, assessment/test preparation, and contracted services
Course development	• Costs associated with developing or purchasing new courses and maintaining or redoing existing courses
Technology setup	• Computers and office setups for all staff members, computers and connectivity for students, the learning management and student information systems, and networking hardware
Technology personnel	• All nonmanagement personnel dedicated to technology, software licenses for all noninstructional staff, and contracted services

Anderson, A. B., Augenblick, J., DeCesare, D., & Conrad, J. (2006, October 2). *20/20: Costs and funding of virtual schools* (Publication). Retrieved from https://www.heartland.org/publications-resources/publications/2020-costs-and-funding-of-virtual-schools

Primary steps in a cost analysis

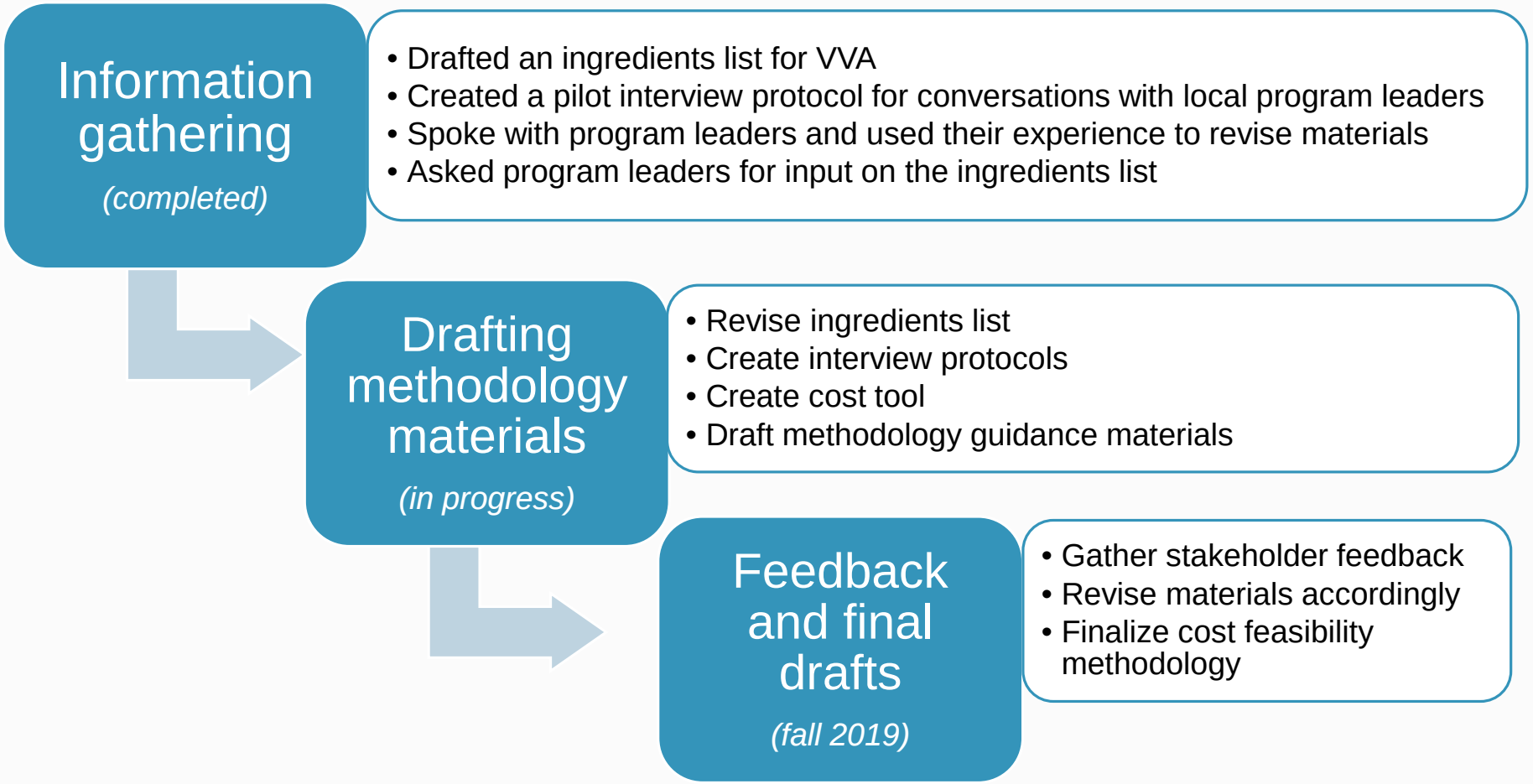


* Cost information may be collected via a combination of administrative records, budgets, interviews, and/or surveys or estimated using national data or costs cited in prior research.

Goals for the VDOE/REL AP collaboration

- Build VDOE staff capacity to conduct cost analyses for online learning programs
- Develop a cost feasibility methodology that the VDOE can implement
- Better understand the local resources needed to implement online learning programs like VVA

Developing the methodology

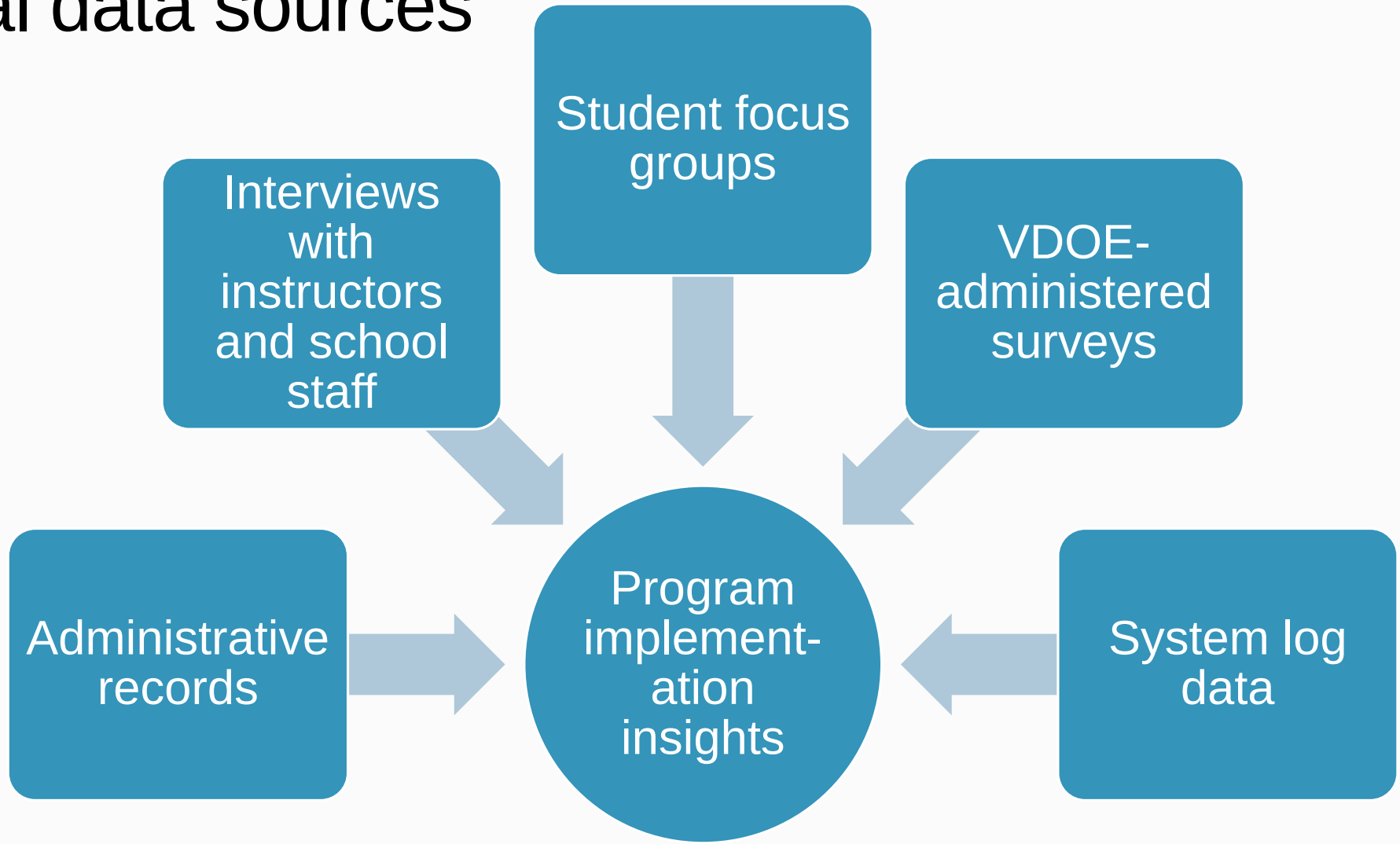


Enhanced collection of program implementation data

Questions about program implementation

- How are VVA online courses implemented?
  - How are online courses “marketed” to students? Who is encouraged to enroll?
  - Where and how do students engage with online courses?
  - What student supports are locally provided and used?
  - What barriers are there to participation and/or successful completion of courses?
- What implementation factors and characteristics contribute to persistence and achievement in VVA online courses?
  - How does implementation affect student success in online courses?

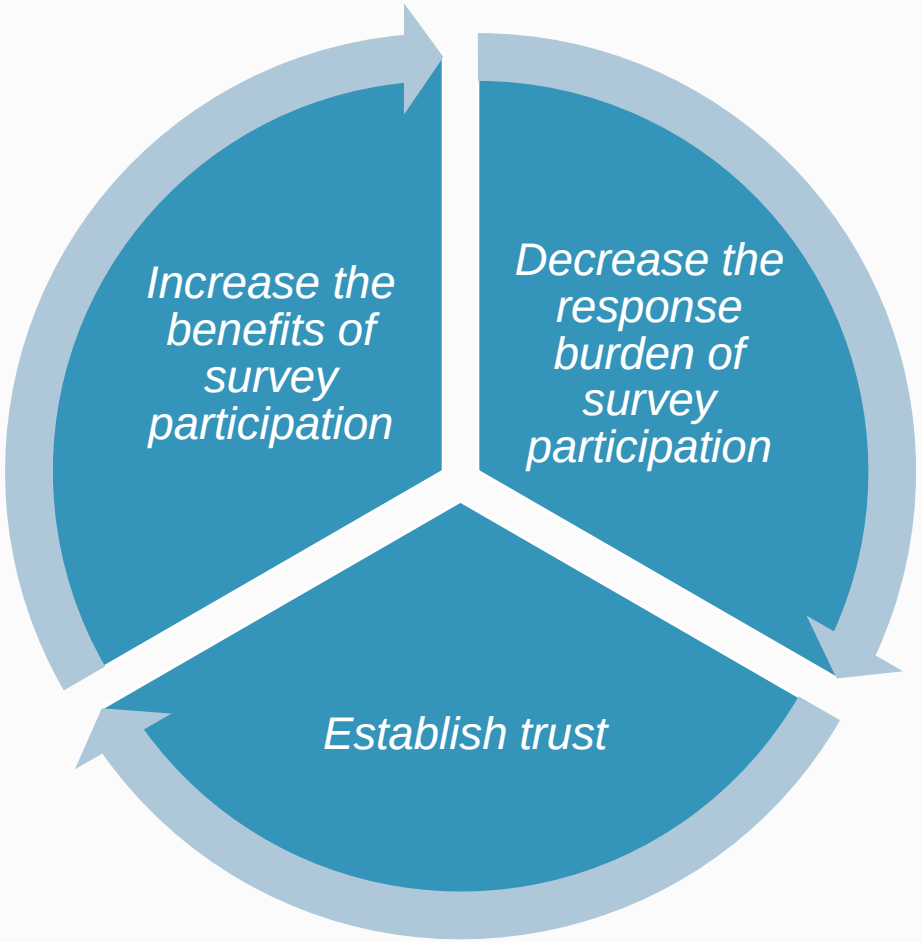
Potential data sources



VDOE-administered VVA surveys

- Three web-based surveys
  - Virginia school staff survey
  - VVA student survey
  - VVA parent/guardian survey
- Challenges with prior survey efforts
  - Low response rates, raising generalizability concerns
  - Targeted respondents (e.g., only VVA course completers)
  - Limited information on implementation conditions and decisionmaking about student participation

Strategies to improve survey response rates



- Encourage responses/reduce burden
  - Students: Embed survey in online course or administer via text; administer survey in school; incentivize with raffle (if allowable)
  - Staff: Have division supervisors endorse participation; provide aggregate school results as an incentive for participating
- Include follow-up procedures for nonrespondents
  - Reminder options

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). Internet, phone, mail, and mixed-mode surveys: The tailored design method (4th ed.). Hoboken, NJ: Wiley.

Opportunities to leverage system usage data

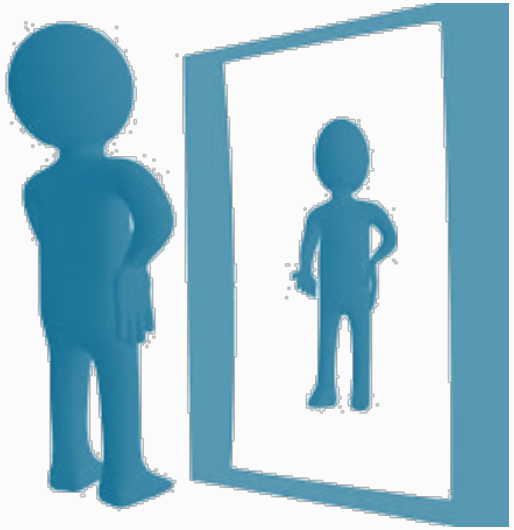
- Automated records of students' and teachers' virtual interactions with the learning management system
  - Offer a profile of the frequency and intensity of technology use and which features of the technology teachers and students used (e.g., videos, assessments, discussion boards).
  - Can be automatically collected and archived at predetermined intervals (e.g., weekly).
  - Provide opportunity to analyze associations between student engagement patterns and performance in the course (e.g., Pazzaglia et al., 2016).

Pazzaglia, A. M., Clements, M., Lavigne, H. J., & Stafford, E. T. (2016). *An analysis of student engagement patterns and online course outcomes in Wisconsin* (REL 2016–147). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Midwest. Retrieved from http://ies.ed.gov/ncee/edlabs

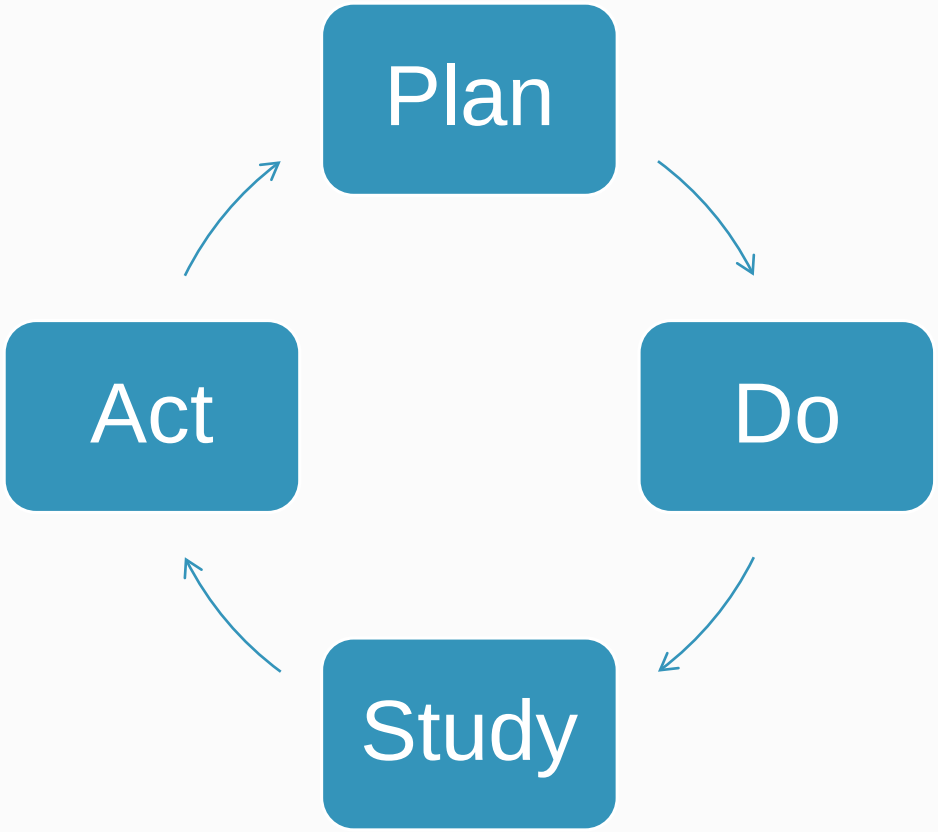
Reflections, next steps, and discussion

Reflections and lessons learned

- Incorporate evaluation principles and metrics into program implementation plans and dedicate resources to build evaluation capacity over time.
- Engage leadership, stakeholders, and decisionmakers throughout the process to ensure evaluation findings are aligned with expectations.
- Don’t let perfect be the enemy of the good; look for ways to strengthen evaluation rigor using extant data and while laying the groundwork for collecting stronger evidence.
- Collect additional data on selection of and retention in online courses to support more rigorous quasi-experimental study designs (e.g., ask reason for enrolling on the VVA course registration form).
- To make sense of student outcomes, incorporate student characteristics, specifics of how the technology is used, and aspects of the learning experience beyond the technology into analyses.

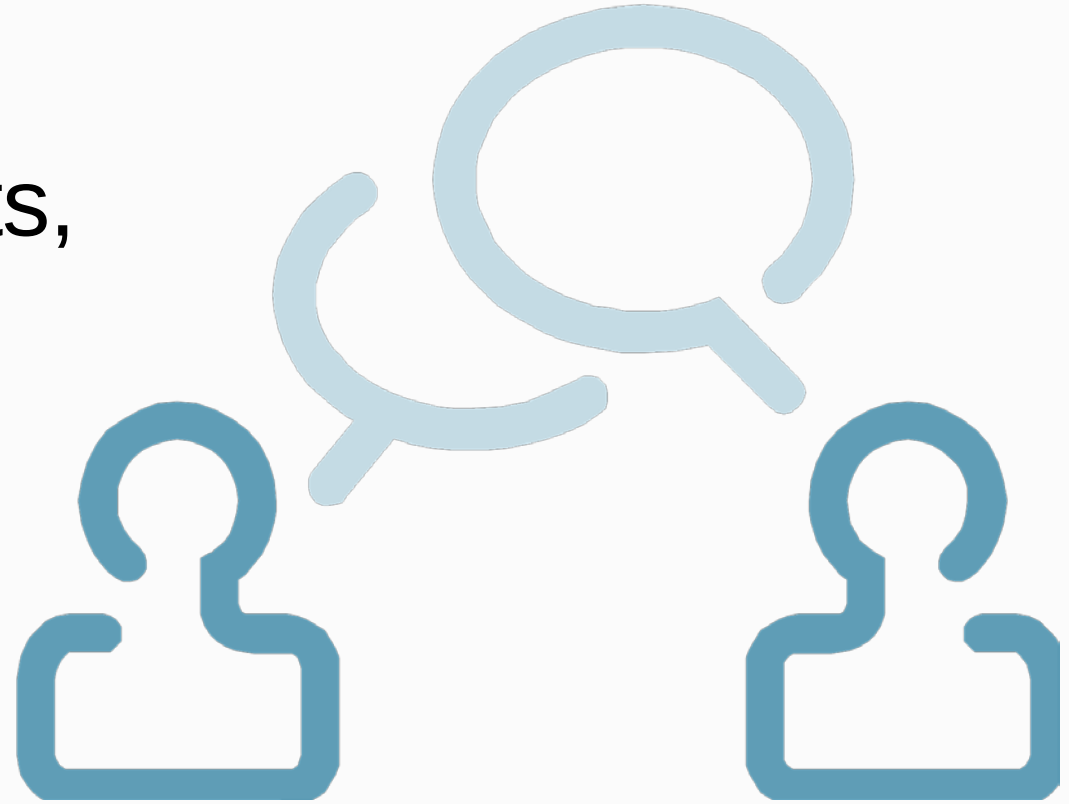


Next steps: Evaluation for continuous improvement



- Complete secondary analysis of student achievement outcomes in VVA.
- Finalize cost feasibility methodology.
- Share and discuss results with key stakeholders, such as VDOE's Virtual Learning Advisory Committee.
- Support VDOE's use of research findings and evidence to improve programs, policies, and practices.
- Support additional study and/or data collection enhancements as needed.

Questions, comments, inspired thoughts, or helpful feedback?



Additional resources

Rigorous analyses of student outcomes

Scher, L., Kisker, E., & Dynarski, M. (2015). *Designing and conducting strong quasi-experiments in education. Version 2.* Design Information Resources, Inc. Retrieved from https://eric.ed.gov/?id=ED561293

Survey methods for educators

Irwin, C. W., & Stafford, E. T. (2016). *Survey methods for educators: Collaborative survey development* (part 1 of 3) (REL 2016–163). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast & Islands. Retrieved from http://ies.ed.gov/ncee/edlabs

Pazzaglia, A. M., Stafford, E. T., & Rodriguez, S. M. (2016). *Survey methods for educators: Selecting samples and administering surveys* (part 2 of 3) (REL 2016–160). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast & Islands. Retrieved from http://ies.ed.gov/ncee/edlabs

Pazzaglia, A. M., Stafford, E. T., & Rodriguez, S. M. (2016). *Survey methods for educators: Analysis and reporting of survey data* (part 3 of 3) (REL 2016–164). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast & Islands. Retrieved from http://ies.ed.gov/ncee/edlabs

Cost analysis resources

Hollands, F. M., & Levin, H. M. (2017). *The critical importance of costs for education decisions* (REL 2017–274). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Analytic Technical Assistance and Development. Retrieved from http://ies.ed.gov/ncee/edlabs

CostOut, the CBCSE Cost Tool Kit (2015) developed by the Center for Benefit-Cost Studies of Education, Teachers College, Columbia University. Retrieved from http://www.cbcsecosttoolkit.org/

Thank you!

Contact REL Appalachia

General inquiries:

RELAppalachia@sri.com

Questions related to improving postsecondary transitions in Virginia:

Jessica.Mislevy@sri.com

Supporting slides

Tools and information learned from cost analysis

Cost analysis can:

- Provide a better understanding of current resources and how they are used (cost analysis ingredients method)
- Identify resource needs for intended policy or program implementation (cost-feasibility analysis)
- Support decisionmakers in efficiently targeting resources to achieve a desired outcome (cost-effectiveness analysis)
- Enable parents, teachers, students, or other stakeholders to share what they value in investments (cost-utility analysis)
- Identify resources that have long-term benefits (cost-benefit analysis)

Cost analysis applications in evaluations

Type of cost analysis	Purpose	Advantages	Disadvantages	Possible applications
Cost-feasibility	To assess whether adequate resources are available to implement a new program[a] as intended or scale up an existing one	• Can be used to swiftly rule out program choices that cannot feasibly be implemented in the decision maker's context	• Considers only costs, not effectiveness, benefits, or utility	To determine whether a district can afford laptops for every student and teacher and the necessary teacher training
Cost-effectiveness	To assess which of several programs produces the desired education outcomes for the lowest cost or maximizes education outcomes for a given amount of investment	• Can be used to decide among alternative program choices • Includes consideration of program effectiveness as well as costs or use of resources	• Can evaluate several programs but only one education outcome (such as reading comprehension) at a time	To decide which of two reading programs will be most effective, relative to its costs, for improving reading comprehension
Cost-benefit	To determine whether the economic benefits of a program exceed the costs	• Can compare the resource requirements and benefits of two or more programs with similar or different objectives	• Requires estimating benefits as dollar values	To assess whether the expected benefits of a costly dropout prevention program merit the investment of resources
Cost-utility	To compare the costs of a program with its usefulness to program stakeholders	• Allows consideration of multiple factors beyond effectiveness and costs • Allows multiple stakeholders to participate in the decision about which program to implement • Can be used when little objective evidence of effectiveness exists as yet • Can be used when programs address more than one educational outcome—for example, both reading and math	• Produces results that are relevant only to the context in which the analysis is conducted	To include a variety of stakeholders (such as teachers, parents, and special education coordinators) and various types of evidence (such as effectiveness, costs, parent preferences, and demand on teacher time) in deciding how best to deliver special education services

a. In this table "strategy," "intervention," or "policy" can be substituted for "program."

Source: Adapted from table 1.5 in Levin, H. M., & McEwan, P. J. (2001). *Cost-effectiveness analysis: methods and applications* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Cost Analysis Resources

Resource	Description	Source/link
The critical importance of costs for education decisions	A resource to learn more about cost analyses and their important role in education decisions. With support from the REL, Hollands and Levin provide a short but detailed overview of cost analyses.	https://ies.ed.gov/ncee/pubs/REL_2017274/pdf/REL_2017274.pdf Hollands, F. M., & Levin, H. M. (2017). *The critical importance of costs for education decisions* (REL 2017—274). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Analytic Technical Assistance and Development.
Center for Benefit-Cost Studies of Education.	CBCSE is a research center at Teachers College, Columbia University, that conducts research on the productivity of education programs. Its researchers conduct cost analyses and provide many resources for those interested in conducting their own analyses.	https://www.cbcse.org/
CBCSE Cost Tool Kit.	CBCSE's CostOut tool can facilitate the collection of cost data and the execution of cost and cost-effectiveness analyses. It is free! It was developed under a grant from the U.S. Department of Education, Institute of Education Sciences (Award #R305U130001) with the goal of helping education practitioners, researchers, and policymakers conduct cost analyses and cost-effectiveness analyses of education interventions to facilitate resource allocation decisions.	https://www.cbcse.org/costout