Guide: Who used your technology – and how?

INTRODUCTION

Usage data (also sometimes called system or log data) can be a good way to find out **who** is using education technology and **how**. This information can shed light on **why** a product is or isn't having the desired effect. Pages 1-7 of this guide will walk you through the steps of getting and making use of usage data in your evaluation. Pages 8-14 will provide you with fictional case studies if you would like additional examples on how to utilize usage data. You can find a glossary of terms on pages 14-15 and data templates on pages 16-18.

There is no one format for usage data, as the information captured by a system varies depending on what the technology is meant to do. Here is one example of usage data:

> Schools ID, class IDs or grades are useful for analyzing groups of students

Student ID	School ID	Grade	Total # of Sessions	Total # of Minutes	Average Minutes per Session	Percent of quizzes attempted	Average quiz score
12345	123	2nd	10	125	12.5	66%	80
12346	123	2nd	10	130	13.0	71%	78
12347	123	2nd	14	245	17.5	50%	64
12348	123	3rd	1	10	10.0	90%	86
12349	123	3rd	2	17	8.5	84%	95
12350	123	3rd	0	0	NA	75%	80
12351	123	3rd	1	7	7.0	69%	55

> Each row represents one individual student

> These columns provide insight into how much a student engaged with the system

> These columns shed some light on progress and performance

This example provides a useful summary of technology use and can address some basic questions about which students used the technology and how much.

> Note that you will need more detailed data to explore questions about:
>
> - Usage over time, such as whether students started out using the technology a lot but then dropped off after a few months; or
> - Students' performance on specific topics, such as a unit on geometry or reading comprehension.

STEP 1. DETERMINE WHAT INFORMATION YOU NEED

To get helpful usage data from developers, you will need to communicate exactly what information – i.e fields in the dataset -- you want extracted from the technology. Figuring out what data you want starts with determining what questions you wish to answer. For example:

- ☐ **Is the education technology being used as intended**? To answer this, you may want to know which students (or other users) are logging into the system, how frequently they log in, and how long they typically spend logged in.
- ☐ **Are students showing signs of learning in the system**? To answer this, you may want to look at whether students attempt embedded assessments and how they score. Consider, too, how well the assessments in the system align with the learning objectives.
- ☐ **Are students 'gaming' the system**? This might be the case if you see students making lots of attempts at assessments, or if they spend very little time using instructional materials.
- ☐ **Are teachers making use of the technology?** Information about when and how often teachers log into the system could tell you whether they are using the technology to monitor student progress or for other purposes.

> **Note:** By combining usage data with administrative data on student background characteristics or outcomes, you can explore important questions that can't be addressed with usage data alone. For example, are there differences in usage behavior for different types of students? Is more time spent in the education technology associated with better outcomes?

STEP 2: GET USAGE DATA FROM EDUCATION TECHNOLOGY PROVIDER

If the educational technology has a feature to download reports, start by seeing what information is readily available. Do these reports provide the data you need, or will you need to contact the educational technology provider for a custom data file?

When requesting a custom data file, consider the following:

☐ **Do you want data for individual students?** Student-level data is necessary for analyzing questions about different types of students or correlations between technology use and external outcomes.

☐ **Do you want data to be grouped by teacher, class, grade, or school?** Getting data aggregated by groups can make data sets more manageable. In general, averages are more useful than raw totals. For example, it is more helpful to know the average amount of time spent per student for each class (basically the total time divided by the number of students) than the total amount of time spent.

Here are examples of questions you can address with different levels of data:

If you have…	*You can address these types of questions…*
Student level data	• What is the association between usage of the technology and student outcomes? • Do students with different background characteristics (i.e., prior knowledge, socio-economic status) have different outcomes associated with the technology? • Are there differences in usage behavior for students with different characteristics?
Classroom level data:	• Which classes actively used the technology? • How often and for how long was the technology used across classes? • Did class growth on particular topics correlate with use of corresponding modules in the technology?
School/District Level data:	• How many teachers used the system? • Over what time period was the system used? • What was the average session duration across the school/district? • What features / types of content were used most frequently?

Tip: Getting student-level data with class and school IDs gives you the flexibility to aggregate at different levels to address different questions. If you get data that is already aggregated by class or school, you will have less flexibility to analyze it in different ways.

Additional considerations:

☐ **How will you match usage data from the technology with district data on student outcomes and backgrounds?** Try to obtain data files with student identifiers that match with other datasets, such as district IDs.

☐ **What type of file do you want?** In order to analyze usage data, you will need reports in formats that allow data to be manipulated, such as Microsoft Excel or CSV files.

☐ **Do you want "long" or "wide" format data?** Long data has multiple rows per student, while wide data has one row per student. Having multiple rows per student can be more manageable if, for example, you want data on student progress and performance for lots of time periods or topic areas.

Example of "long data":

Note that some student IDs appear on multiple rows

Student ID	Class ID	Goal	Average score	% of learning path completed
12345	123	Geometry	90	100%
12345	123	Measurement & data	60	30%
12345	123	Number & operations	67	50%
12346	124	Geometry	85	60%
12346	124	Measurement & data	77	55%
12347	125	Geometry	89	100%
12347	125	Measurement & data	68	40%
12347	125	Number & operations	76	50%
12347	125	Operations & Algebraic Thinking	56	70%
12348	450	Geometry	92	40%

Example of "wide data"

Student ID	Class ID	Geometry: Average Score	Geometry: % of Learning Path Completed	Measurement & Data: Average Score	Measurement & Data: % of Learning Path Completed	Number & Operations: Average Score	Number & Operations: % Learning Path Completed
12345	123	90	100%	60	30%		
12346	124	67	50%	85	60%		
12347	125	89	100%	68	40%	76	50%
148	450	92	40%				

STEP 3: CREATE DESIRED TABLES

The data files you receive from technology providers may not present information in exactly the format you want. For example, if you receive multiple lines for each student showing performance on different modules, you may wish to aggregate these to generate one row for each student (as in the example shown above). Or, you may wish to add additional columns to calculate averages and ranges in order to address the specific questions you wish to answer.

Worked Example 1: Is the product being used? How much?

Student ID	Class ID	Total # of Sessions	Total # of Minutes	Average Minutes per Session
12345	123	10	125	12.5
12346	123	10	130	13.0
12347	123	14	245	17.5
12348	450	1	10	10.0
12349	450	2	17	8.5
12350	450	0	0	NA
12351	450	1	7	7.0

With some manipulation, the following table can be produced that addresses the research questions more directly:

Classroom	% using at all	% using recommended amount*	Average minutes / session (excludes non-users)	Range of minutes / session (excludes non-users)
All	85%	50%	14.1	7.0-17.5
123	100%	100%	14.3	12.5-17.5
450	75%	25%	8.5	7.0-10.0

*for this example we assume recommended amount is 10 minutes/session

Worked Example 2: How are students doing on assessments within the system?

Student ID	Class ID	Goal	Average score	% of learning path completed
12345	123	Geometry	90	100%
12345	123	Measurement & data	60	30%
12345	123	Number & operations	67	50%
12346	124	Geometry	85	60%
12346	124	Measurement & data	77	55%
12347	125	Geometry	89	100%
12347	125	Measurement & data	68	40%
12347	125	Number & operations	76	50%
12347	125	Operations & Algebraic Thinking	56	70%
12348	450	Geometry	92	40%
12349	450	Geometry	88	32%
12350	450	Geometry	71	50%

In Class 450, students perform relatively well on tests despite being less likely to complete the learning path. It is possible that the teacher is using the product as an optional supplemental resource.

With some additional manipulation, the following table can be produced that describes performance at the student level:

Students	Average Score	% learning path completed
All	76.6	62%
12345	72.3	60%
12346	81.0	57%
12347	72.3	65%

Student with the highest average score has completed a relatively low percentage of learning paths. Again, this suggests that the product is being used as a supplemental resource.

Alternatively, you can create a table showing class performance on various goals in the system:

Class ID	Goal	Average score	% learning path completed
All		76.6	62%
123	Geometry	72.3	60%
123	Measurement & data	81.0	57%
123	Number & operations	72.3	65%

STEP 4: MATCH WITH ADMINISTRATIVE RECORDS

Many evaluations entail analyzing associations between student use of technology and performance on external assessments, such as standardized tests. Most study designs also involve comparing students with similar background characteristics, meaning that background data such as age, gender, race/ethnicity, and prior academic achievement also need to be factored in.

In these cases, once you have cleaned the usage data and organized it the way you want, you will need to merge the usage data file with administrative records. This is where having common unique student IDs is important.

Fictional Case Study 1

Lebanon Public Schools (LPS) recently acquired the reading comprehension system TigerRead. Administrators at LPS are interested in examining how TigerRead is being implemented within the district. Specifically, administrators wish to know whether teachers were actually using the system with their students intensively enough that impacts on learning would be expected. The administrators form the question "*How often is TigerRead used in classrooms throughout the fall semester?*"

To answer this question, LPS administrators had to get specific usage data from the TigerRead developers. In thinking about the exact data needed to answer their question, LPS administrators realized that they weren't sure whether the total amount of time or the number of sessions working with the system was more important. They decided to ask the TigerRead developers for four pieces of information:
1) A classroom identifier
2) A metric of time
3) The total number of sessions associated with each time period, and
4) The average amount of time spent in the system during the corresponding time period.

Each of these pieces of information played a crucial role in helping LPS administrators answer their question.
- The **classroom identifier** allowed for the examination of use across classrooms, thus LPS administrators could see which classrooms were using the learning system to different extents and could understand the variation in implementation patterns.
- A **metric of time** (such as day, week, or month) provides the unit of analysis for examining intensity of system use. The smaller the unit, the more data administrators will have to analyze, but if units are too coarse (say semester or year), important differences in usage patterns may be missed.
- **Total number of sessions per time period** allows for the examination of frequency of use. This may be useful for examining how TigerRead is used across time (i.e., Is the system used mostly at the beginning or end of the semester? Is it used in many short sessions or a few long sessions?).
- Finally, the **average time spent** in the system during the corresponding time period provides a view of the length of time that students worked on the system during that period.

In our example, administrators at LPS worked with developers at TigerRead to identify the specific variables and data fields needed to answer their question (see Figure A).

Figure A

Unique identifier for each classroom	Month of the year that the system was used	Total # of sessions a classroom used TigerRead during this period	Average time a classroom spent per TigerRead session

Classroom ID	Month of Year	Total # of Sessions	Average Time per Session
123	September	10	25
123	October	8	30
123	November	6	45
123	December	0	0
456	September	0	0
456	October	5	34
456	November	8	20
456	December	10	30
789	September	7	20
789	October	7	25
789	November	7	24
789	December	7	27
467	September	2	10
467	October	10	20
467	November	3	30
467	December	10	35

Once LPS administrators had this data, they needed to think about the best ways to analyze it to address their question. They started, as many data analyses do, by compiling descriptive statistics. These included classroom averages, medians, and ranges for number of sessions and length of session for each of the four months in the data set.

In the above example, LPS administrators want to examine how often TigerRead is being used within district classrooms. A good introductory analysis that LPS administrators can conduct to investigate their question would be examining the overall average number of minutes that the system was used monthly by each class. Using the descriptive statistics on 1) average time spent per class, 2) average time spent per month, and 3) their corresponding ranges, LPS administrators generated a descriptive data report (see Figure B) and visual charts (see Figure C). Administrators can use these reports to better understand *how* and *when* TigerRead is being used.

Descriptive Statistics

Statistics that describe, show, or summarize data in a meaningful way.

Figure B

Summary of TigerRead Use (Minutes per Month)

Class ID	September	October	November	December	Average Across Months	Range Across Months
123	25	30	45	0	25	0-45
456	0	34	20	30	21	0-34
467	10	20	30	35	23.75	10-35
789	20	25	24	27	24	20-27
Monthly Averages	13.75	27.25	29.75	23	23.44	

Figure C
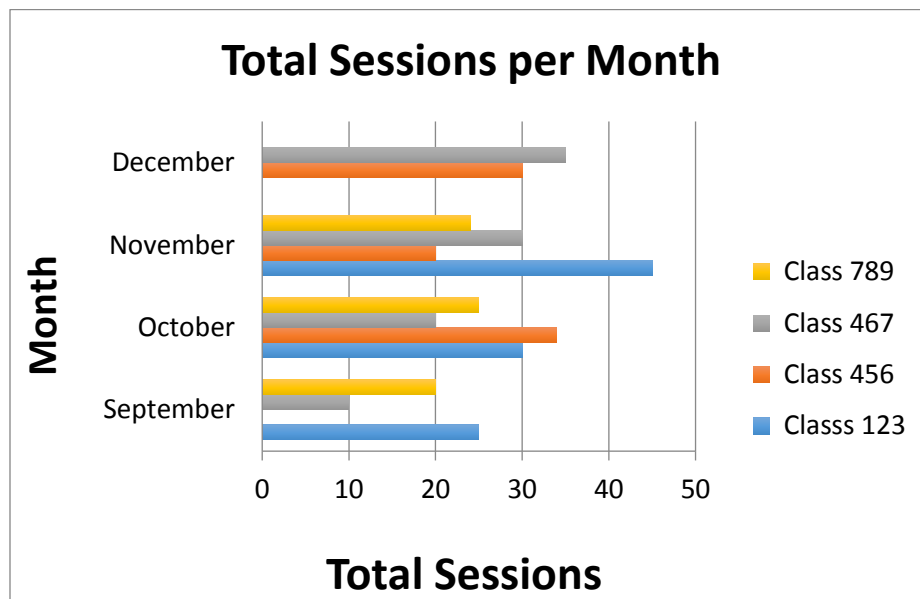
Using Figures B & C, LPS administrators can get a sense of the use of TigerRead. For instance, using Figure B, administrators can see that overall TigerRead was used an average of 23 minutes per month across all four classes. They can also use Figure B to see the monthly breakdown of average minutes spent in the class per system. This data provides insight into how TigerRead is being used by each class and across time. For example, it may be useful to learn that classroom 789 has the highest average usage but the narrowest range of use, suggesting more consistent adoption than class 123, which has a high upper bound but a large range and relatively low average.

Similarly, the bar graph presented in Figure C, provides a visual chart of the descriptive statistics. Through this figure, administrators can visually compare each class's use of TigerRead to the others across months in the fall semester. The chart shows that there was substantial variation across classes in terms of patterns of use.

Fictional Case Study 2

Lebanon Public Schools (LPS) administrators are interested in examining students' learning growth within the TigerRead system. Specifically, administrators wish to know how students' reading comprehension skills change overtime and how those changes can be tracked within the system. LPS administrators come up with the question "*How does students' use of TigerRead correspond to changes in their reading comprehension ability?*"

Similar to Example 1, LPS administrators need to get specific usage data from the TigerRead developers in order to answer this question. Again, it is important to think about the exact data that you need to answer your question. For the current example, LPS administrators need at least four pieces of information:

1) A student identifier
2) A metric of time
3) Activity type
4) Metrics of performance within the system related to reading comprehension

Each of these pieces of information plays a crucial role in helping LPS administrators answer their question.

- The **student identifier** allows for the examination of each student's specific use and performance within TigerRead. Thus, LPS administrators could see which students were using the learning system to different extents and could understand the variation in usage patterns.
- A **metric of time** (such as day, week, or month, can also be session #) provides an indicator of how often (and at what frequency) TigerRead was used by each student.
- **Activity type** provides metadata information concerning the type of activity a student engages in (where the performance data is collected).
- **Metrics of performance within the system** allows for the examination of performance and thus growth across time. This may be useful for examining changes in reading comprehension as students use the TigerRead system.

In our example, administrators at LPS worked with developers at TigerRead to identify the exact variables and data fields needed to answer their question (see Figure D).

Figure D

Unique identifier for each student

The session number that corresponds to the performance metric

Information concerning the type of activity where the performance data is collected

Student ID	Session Number	Activity Type	Performance Metric
Student A	1	Quiz	100%
Student A	2	Checkpoint	80%
Student A	3	Quiz	96%
Students A	4	Quiz	100%
Student B	1	Quiz	50%
Student B	2	Checkpoint	70%
Student B	3	Quiz	80%
Student B	4	Quiz	100%
Students C	1	Quiz	70%
Students C	2	Checkpoint	85%
Students C	3	Quiz	85%
Students C	4	Quiz	95%
Students D	1	Quiz	20%
Students D	2	Checkpoint	70%
Students D	3	Quiz	80%
Students D	4	Quiz	100%

The score or grade that a student earned while interacting with a specific activity
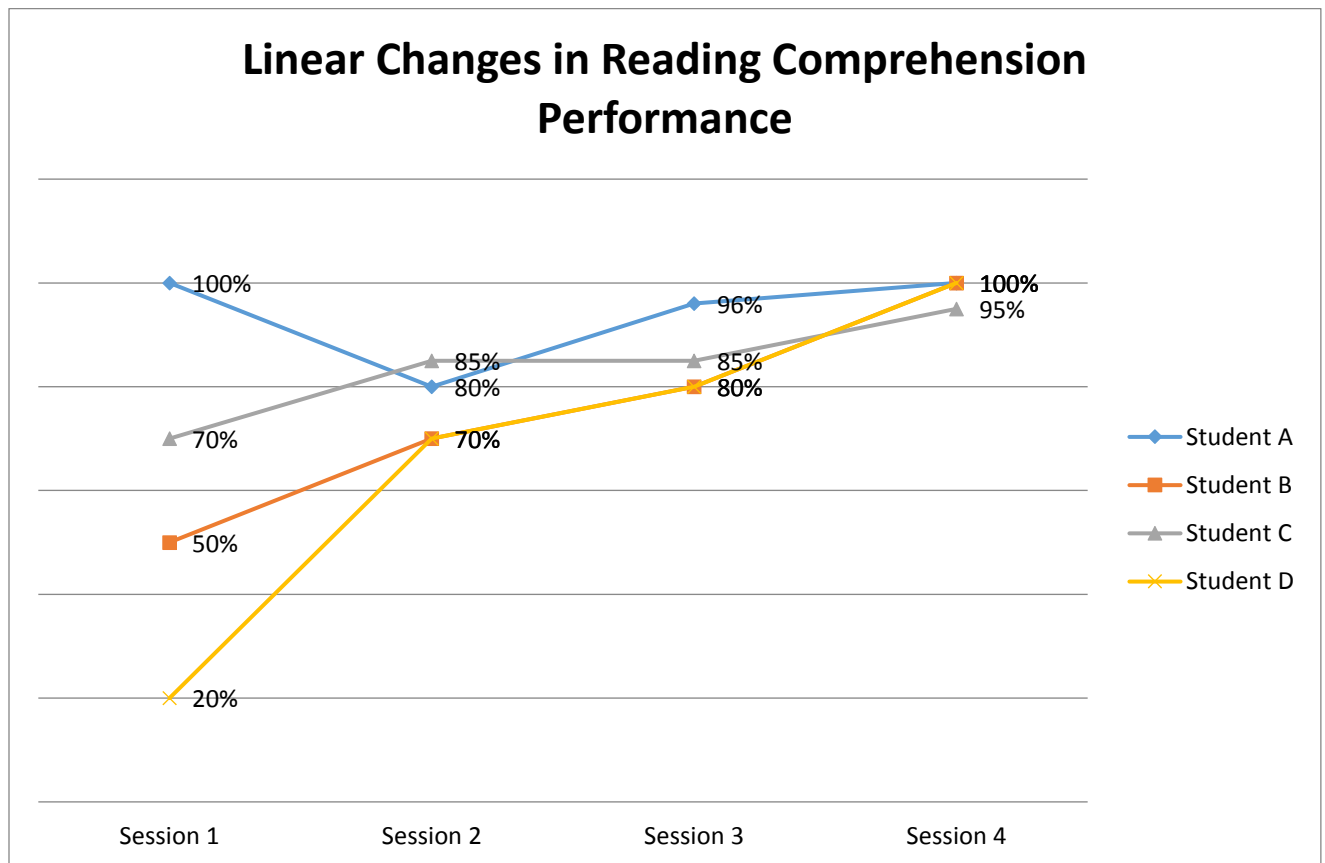
Again, after data is obtained, LPS administrators need to think about the best ways to analyze it as a means to answer their specific question.

In this example, LPS administrators are interested in growth over time. Specifically, they want to examine how students' reading comprehension skills change overtime and how those changes can be tracked within TigerRead. An introductory analysis that LPS administrators can conduct to investigate their question would be examining trends (both growth and decreases) in performance across time by plotting each student's performance by session. Using the variables 1) students ID, 2) session number,

and 3) performance metric, LPS administrators can generate a visual chart (see Figure E) to better understand *changes* in students' performance across time.

Figure E

Linear Changes in Reading Comprehension Performance

Student A — 100%, 80%, 96%, 100%
Student B — 50%, 70%, 80%, 100%
Student C — 70%, 85%, 85%, 95%
Student D — 20%, 70%, 80%, 100%

Sessions: Session 1, Session 2, Session 3, Session 4

Legend: Student A, Student B, Student C, Student D

Using Figure E, LPS administrators can get a sense of how students' performance in TigerRead changes across time. For instance, using Figure E, administrators can see that overall students' performance seemed to improve over time, with each student's end performance (session 4) being higher than their starting performance (session 1). Moreover, the data show that students initially had wide gaps in performance within the system, but that these gaps nearly closed after four sessions.

Reflection

In the above examples LPS administrators were able to work with TigerRead developers to successfully extract usage data to answer their question. However, this process is not always as smooth as demonstrated above. Indeed, there is often a need to iterate and refine the data that is pulled from the system. The need for this kind of iteration often stems from difficulty communicating exactly what data you're referring to when the person you're talking to has vastly different experiences with the learning system software and with educational decision making than you do.

One way to avoid this extra work (and frustration) is to find common terminology with developers as well as express the ultimate goal of using the usage data. For instance, asking a developer for time-stamped data will not provide you with the specific information you need to examine the question for example 1: "How often is TigerRead used in classrooms throughout the fall semester?" Instead, it is important to express the exact nature of your question as well as the variables and fields you wish to examine.

Some Common Data Terms:

This short glossary is designed to provide clarification about the various types of data terminologies you may encounter and associated definitions. Please note that there is overlap between some terminologies, as many are used interchangeably.

Terminology	Definition
System / log data	Information concerning the actions and events that users engage in during system use.
Process data	Information concerning a series of actions or events in a system.
Clickstream data	Information concerning the sequential order of users' events and mouse clicks in a system.
Usage data	Describes all types of user interactions with a system.
Learning data	Describes user interactions with a system indicating student achievement on formative and summative assessments and/or capture student behaviors related to learning.
Key strokes	Information concerning the keys struck on a keyboard during users' time in a system.
Time stamps	Information concerning when an event took place (i.e., logins, logouts, action completion). Often includes dates and times.
Session	The time a user spends interacting with a system during one sitting, often between logging in and logging out.
Event	Any discrete action a user takes within a system, such as submitting responses to an assessment or viewing an instructional video.

Metadata points	Information concerning the content or topic addressed by a particular unit within a program.
Natural Language Processing (NLP)	Information concerning users' discourse with and in a system (i.e., written or oral).
Mouse tracking	Information concerning the use and movement of users' computer mouse during their time in a system.
Telemetry	Information concerning how a system is used. Often associated with technical aspects of the system (i.e., browser, errors, runtime, number of users on the system).
Performance Metrics	Information concerning users' achievement or progress during system use.

Template A: Summary Data

Student ID	Class ID / Teacher ID	School ID	Grade	Total # of Sessions	Total # of Minutes	Average Minutes per Session	Total # Assessment Attempts	Average Score on Assessments	Minimum Score	Maximum Score

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Template B: Usage Data by Topic Area

Student/ Class/ School ID	Unit/ Topic/ Module/ Lesson Name	% of Students Attempted	% of Students Completed	Average Score on Assessments	Average Minutes of Use	Minimum Score	Maximum Score

Template C: Usage Data by Time Period

Student/ Class/ School ID	Period 1 # Sessions	Period 1 Total # Minutes	Period 2 # Sessions	Period 2 Total # Minutes	Period 3 # Sessions	Period 3 Total # Minutes	Period 4 # Sessions	Period 4 Total # Minutes