

Chapter 2

Step 2: Formulating Hypotheses



2.1 Introduction

Once a problem definition has been formulated, the team can proceed to step 2 of the data teamTM procedure and formulation of hypotheses pertaining to the possible causes of the problem. First of all, possible hypotheses must be gathered (Sect. 2.2). Sections 2.3 and 2.4 cover the various types of hypotheses that can be drawn up. Finally, Sect. 2.5 explains how to make these hypotheses measurable.

2.2 Gathering Hypotheses

Now that the team knows *what* the problem is exactly, they work on discovering the *why* of the situation: what is the cause of the problem? How come 20% of the grade 6 students are failing this grade, for example? Why are 42% of students, on average, failing mathematics in grade 9? The goal of step 2 is to draw up a hypothesis or a supposition about the cause of the problem. Team members often have different ideas about what may be causing a problem, usually based on their own experience, but also on assumptions and gut feelings.

You can also start by looking for possible causes for the problem in the literature (professional literature and/or scientific literature). Topics such as grade retention and unsatisfactory mathematics performance have been studied before. It is also advisable to consult colleagues about what they think might be causing the issue. This can be done in a variety of ways, ranging from discussing the matter informally in the teachers' lounge to making a formal request by means of an email to all of the staff. Examples of how teams got colleagues involved in this step are: making a request in the school magazine, putting up flip-charts in the teachers' lounge and hosting brainstorming sessions within the various teams at the school.

Involving colleagues in this step of the process also allows the team to generate more support for the topic they are working on. That is of major importance for two reasons. First of all, it is important that colleagues take the results of the team's work seriously. After all, there is a significant chance that the team will eventually come up with measures that affect their other colleagues. Secondly, involving colleagues in the project initiates a discussion about the importance of data use at the school.

2.3 Types of Hypotheses

When drawing up hypotheses, we differentiate between exploratory and explanatory hypotheses. An exploratory hypothesis concerns further specification of the problem, without going into the actual cause. It is all about the question of *where* or *with whom* the problem mostly occurs. Examples include the team who believes that the high percentage of failing students in grade 6 mainly occurs among boys, or the team who believes that the problems with grade 6 are mainly due to the influx of second-language students. This type of hypothesis is about specifying the problem to identify a certain group of students. Here is an example of one such hypothesis: "Significantly more boys than girls are failing mathematics in grade 9." This narrows down the problem and makes it more specific. The problem may only affect a certain group (boys or girls).

An explanatory hypothesis names a possible cause for the problem. Think of a lack of motivation among second-language students, for example, or a perceived

lack of study skills among boys. These are possible causes that offer clear starting points when it is time to take improvement measures.

Furthermore, it is possible to work with a research question rather than a hypothesis. A hypothesis can be investigated using quantitative data (see also the introduction), such as test scores, progress data with regard to how many students progressed to the next grade level, or scores on a questionnaire. A research question can be answered with qualitative data. These are data that mostly make use of information of a qualitative nature which can be used to describe and interpret research problems in or related to situations, events and people. They include the opinions, experiences and behavior of students, teachers and parents, for example. It is common to use interviews or observations to collect qualitative data.

There are several reasons to formulate a research question rather than draw up a hypothesis. Perhaps the team does not yet have a specific idea what might be causing the problem, or maybe they want to know what leads to certain behavior or certain scores. Perhaps the team has drawn up a long list of hypotheses, but none of these appear to really explain the problem. One of the teams, for example, looked into the high percentage of students who failed to graduate. The quantitative data collected by the team did not provide an answer to this problem. The team was not able to discover a pattern for the group of students who had failed to graduate. They then decided to ask the students themselves what their experience of their final year of high school had been like and what they believed had caused them not to graduate.

It is an eye-opener for many teams that qualitative research is also an option, in addition to quantitative research. “Is it really OK to go around asking our students what they think?” is a commonly heard question. The answer is “yes”: the eight-step procedure can be used for both qualitative and quantitative research. In practice, the two can reinforce each other or be used in sequence. For example, a team might proceed to formulate a hypothesis after answering the research question, or vice versa. One team discovered—after interviewing several students—that a surprisingly large number of them indicated that their own efforts were an important reason for their failure that year. The team can then decide to use a motivation questionnaire to investigate this hypothesis among all students in a quantitative way. On the other hand, if a team cannot gain any insight into the cause of a problem, even after investigating multiple hypotheses, interviewing students might shed more light on the matter.

2.4 Internal and External Hypotheses

Teams often start by investigating so-called external hypotheses, causes that are located outside themselves: the problem is caused at the earlier grade levels, by the school’s policy, by the lack of motivation among students. These ideas are born from the experiences or gut feelings of teachers and school leaders. It is important to take these experiences seriously and investigate them, although these external

hypotheses often turn out to be false. Nevertheless, starting with an external hypothesis is an important step in a team's learning process. It serves as a first exercise with the eight steps for a (sometimes newly established) team whose members have yet to learn how to utilize data. Investigating an external hypothesis is a relatively safe way to do so, as it does not concern their own performance as teachers.

Furthermore, learning often starts by making mistakes. Discovering that some assumptions are false is an important lesson to learn. Additionally, by disproving an external hypothesis, the team discovers early on in the research process how important data are: if the initial hypothesis that everyone believed to be true is actually false, what else might be false as well? An example of this is a team that was looking into a problem regarding low math scores in the first year of middle school. For years, teachers had believed that the students from two specific elementary schools achieved lower scores year after year compared to students from other elementary schools, which was thought to have a negative impact on the results. This hypothesis proved to be false. For a number of teachers, this came as a major surprise and it served as an important lesson for these teachers regarding the use (and usefulness) of data.

Investigating external hypotheses can also help dispel many myths that exist within a school. A team investigating grade retention in middle school had come up with a long list of possible hypotheses after consulting colleagues. Many of these were external hypotheses. Although the team members did not believe in these hypotheses themselves, they decided to look into some of them anyway. Their intention was to dispel some persistent myths once and for all and pave the way for serious examination of the quality of education provided at the school. It worked. Confronted with the disproving of these hypotheses, teachers said: "if the problem does not lie with the elementary schools, nor with our students' motivation, nor with our school's policy, we should perhaps reconsider what we are doing in our own classrooms."

2.5 Making Possible Hypotheses Measurable

A team often has a long list of possible causes for a problem. The team has to decide which hypothesis to investigate first. There are many possible reasons for a team to choose a given hypothesis to start with. Some teams choose to start with the hypothesis that seems most popular among staff. Other teams also consider the extent to which the school would be able to influence the cause of the problem, should the hypothesis prove to be correct. Another important consideration is whether it is even possible to investigate the hypothesis in question with the use of data.

If one or several possible causes have been selected for further research, it is important for each of these to be translated into a hypothesis. A hypothesis is formulated in a concrete and measurable manner. This often proves to be quite a

challenge for teams. A team commonly starts with causes such as “this is the elementary schools’ fault,” “we have too many students failing their grade level because of the school’s policy” or “it is because of the influx of second-language students.” These examples are not concrete or measurable. It is therefore important to consider what data are necessary to investigate the hypothesis. An example of a concrete and measurable hypothesis is “second-language students score at least 1 point lower on their grade 9 mathematics assessment compared to non-second-language students.” This hypothesis is concrete, measurable and immediately makes clear what data need to be collected during the next step of the process.

Initially, a team often investigates only a single hypothesis at a time. Collecting data, analyzing these data and engaging in discussions based on these data are all new to the team members. It is therefore advisable to start small. Once the team has acquired some experience, they can investigate several hypotheses at a time and collect multiple types of data during step 3.

The Data Team™ Procedure: A Systematic Approach to
School Improvement

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2018, XXII, 84 p. 8 illus., Softcover

ISBN: 978-3-319-58852-0