The EA algorithm

One of the challenges in allocating EAs to schools is being able to weigh relevant criteria during the decision-making process. Furthermore, the method for making these decisions must be replicable and transparent. Two criteria that play a major role in determining the allotment of EAs, are the needs of the student and the finite number of available EAs. Weighing these factors “by hand” or by using only one’s intuition, can be an opaque and onerous decision-making approach. Therefore, the goal of the EA algorithm is to balance these two factors using computational techniques that provide an initial decision for the allotment of EAs. Again, this is only the first pass at the decision-making process. After the algorithm provides results, the special education staff examine the numbers and adjust according to their expertise. The algorithm can only work if there is a way to quantify student need. For this, it relies on the Halton Catholic District School Board’s independence rubric.

The independence rubric assesses special-needs students in seven domains: health/medical, safety, adaptive functioning, communication, social/emotional, academic, and community/leisure/work. These domains are further broken down into more specific subdomains. For example, under adaptive functioning, the subdomains include toileting, feeding, dressing, mobility, and personal hygiene. For each subdomain students are categorized as either level 1, 2, 3, or 4. The four levels represent how much support a student requires in any given area. For example, Level 1 indicates that much support is required, whereas level 4 indicates that no support is required. The categorizations provide a foundation for the EA algorithm in terms of the quantification of student need.

The EA algorithm begins by transforming the four categories into numbers in that fall within the unit interval (0 to 1). For example, consider the following mappings:

Level 4 ⇒ 0

Level 3 ⇒ .2

Level 2 ⇒ .6

Level 1 ⇒ .8

This mapping of categorical values to numbers in the unit interval is not arbitrary. One can imagine that a student in a particular domain who is a level 1 (on average), may require 80% of an EA’s time (or .8 of an EA). Therefore, the mappings have a quantifiable meaning and these particular mappings are chosen based on consultation with special education staff. As described in the following section, these particular values may get adjusted up or down by the algorithm and therefore what is most important when choosing a mapping is the relative space between values. That is, one must consider how much more support a level 1 should generate compared to a level 2, and so on. Following the mappings, the algorithm begins an iterative process of balancing student need with the finite number of available EAs.

An estimate of the support required for a particular student is given by first averaging the values within each domain (yielding domain-specific estimates), and then averaging across these the domain-specific estimates (yielding a grand average). Since the mapped values represent proportions, for any given school, the sum of the mean values across students represents the number of EAs required for that school. In this manner, the algorithm initially gives the full amount of support to students (as determined by the mapped values) with no restriction imposed by the finite number of available EAs. If there are more EAs left after the initial allotment, the remainder is divided across all students equally. On the other hand, if too many EAs were allotted, the debt is divided by the number of students and that values is subtracted from each record. In either case, the sum across students will be equal to the total number of EAs that were available.

There are edge cases that must be dealt with based on any specified “floor” or “ceiling” parameters. For example, if we specify that quantities should not be negative, the algorithm will ensure that this will be the case. Likewise, if we specify that quantities should not exceed .8 support, then the algorithm will make sure that this is the case as well.

The algorithm finishes quickly and produces a number of reports for the special education staff. The reports detail how much support each student was assigned (in terms of a proportion of an EAs time) and how many EAs are allotted to each school. The algorithm should be rerun using different mapping parameters until the results produce a good fit with selected cases as determined by special education experts.

The EA algorithm uses intuitive computational techniques to balance two factors that are important given this particular decision-making challenge. When accompanied with special education expertise, the algorithm provides a fast and transparent method for staffing allocations.

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