

## Why W|A will have a faster adoption rate in math than other CAS-technology

Rogers' Diffusion of Innovation theory postulates that five attributes explain 49 to 87% of the variance in the rate of the adoption of innovations (1995): relative advantage, compatibility, complexity, trialability, and observability. In addition, there are variables that also affect the rate of adoption: type of innovation-decision, nature of communication channels, nature of social system, and the extent of change agents' promotion efforts. Below, I will attempt to summarize these attributes and variables and compare W|A with past CAS technology (handheld devices and CAS software).

| Attribute or Variable and description                                                                                                                                                                                                    | CAS Technology (handheld calculators and software)                                                                                                                                      | Wolfram Alpha                                                                                                                                          |
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| <b>Relative advantage:</b> the degree to which an innovation is perceived as being better than the idea it supersedes. (strongest predictor of the success of an adoption)                                                               | CAS technology in calculators and software continued to have a learning curve which made it difficult to just sit down and use. You had to know exactly how to ask for what you wanted. | W A is similar to search engines we already use, and because it just assumes you want all knowledge of a topic, the learning curve is relatively flat. |
| <b>Economic Advantage:</b> The initial cost of an innovation may affect its rate of adoption. Higher cost? Lower adoption.                                                                                                               | CAS technologies had costs (usually over \$100 per copy or device).                                                                                                                     | Free.                                                                                                                                                  |
| <b>Social status:</b> Adoptions sometimes occur from the desire to gain social status. This is extremely difficult to measure.                                                                                                           | Instructors may have wanted to be perceived as cutting-edge. Students may gain status amongst their peers for "figuring out" how to game the system.                                    | Instructors may want to be perceived as cutting-edge. Students may gain status amongst their peers for "figuring out" how to game the system.          |
| <b>Overadoption:</b> the adoption of an innovation by an individual when experts feel that it should be rejected. This happens based on insufficient knowledge, inability to predict consequences, or status-conference of the new idea. | Because there was a need for buy-in with students or departments, overadoption was not likely.                                                                                          | Some instructors are already making changes to courses and introducing students to W A without considering overall consequences.                       |
| <b>Complexity:</b> the degree to which an innovation is perceived as relatively difficult to understand and use; complexity is negatively related to its rate of adoption                                                                | There were definitely learning curves in most CAS technologies. You had to know exactly what series of steps or commands to use to obtain the knowledge you desired.                    | The less you ask for, the more you get. W A assumes you want all the information it can generate.                                                      |
| <b>Trialability:</b> The degree to which an innovation may be experimented with on a limited basis; trialability is positively related to the rate of adoption                                                                           | Had to obtain device or software trial to experiment.                                                                                                                                   | Available on any computer with Internet access.                                                                                                        |

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| <p><b>Compatibility:</b> the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters; compatibility is positively related to the rate of adoption</p>            | <p>Math has been split in “reform wars” for years. How much of what we learn is dependent on understanding manipulation and how much is dependent on understanding context? Costs of adoption kept students out of affecting this attribute for the most part.</p>                 | <p>Students, for the most part, have a fragmented conception of the discipline of mathematics and want to get through their math courses with the least pain possible. W A will be compatible with the views of most students. W A should also be compatible with a good percentage of math instructors (esp. from the reform camp), but likely not the rest. Also, there may be a group of instructors who agreed with the ideas behind using CAS, but found cost and student pushback to be significant barriers. These instructors will be quick and willing adopters.</p> |
| <p><b>Observability:</b> the degree to which the results of an innovation are visible to others; observability is positively related to its rate of adoption</p>                                                                              | <p>Students might carry CAS technologies with them as they transfer to another course, instructors might observe CAS usage in their colleagues.</p>                                                                                                                                | <p>W A use can be easily observed by students and instructors sharing URLs in discussion boards, social networking sites, and emails. High degree of observability.</p>                                                                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>Type of innovation-decision:</b> The more people involved in making an innovation decision, the slower the rate. If it is easy for an individual to adopt the innovation, it is more likely to happen.</p>                              | <p>Because of costs involved, it was difficult for an instructor to just change to using CAS technology without getting buy in from students, departments, or other administration.</p>                                                                                            | <p>Any instructor who wants to could begin using W A immediately with their classes. They <b>should</b> consult their departments and colleagues, but they don't <b>have</b> to.</p>                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><b>Nature of Communication:</b> How does knowledge of innovations spread? Mass media (faster) or interpersonal channels (slower). With the Internet, this attribute may now be negated.</p>                                                | <p>Knowledge of innovation was spread through papers, conferences, and interpersonal channels. Very slow. CBMS data shows us how slow computer assignments were taken up.</p>                                                                                                      | <p>Knowledge is spreading via mass media (CNN, NPR, Internet) <b>and</b> interpersonal channels in faculty (email, listservs) and will spread with students (FB, Myspace, “cheat” sites).</p>                                                                                                                                                                                                                                                                                                                                                                                 |
| <p><b>Nature of Social System:</b> The more interconnected the system, the faster the adoption rate.</p>                                                                                                                                      | <p>The network of instructors was not very well connected in communication. Students were uninterested because of cost and difficulty of use.</p>                                                                                                                                  | <p>The network of students today is very well-connected and the barriers to use have been removed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p><b>Extent of Change Agents' promotion efforts:</b> When the opinion leaders adopt, the adoption rate amongst general population is faster. Once a critical mass is reached, the innovation will spread with little promotional effort.</p> | <p>CAS technologies did not reach the point where a critical mass pushed the rest of the adoption. Left alone, CAS adoption might become widespread as changes push through K12 to Higher Ed over the next 10-15 years. (similar to traditional graphing calculator adoptions)</p> | <p><b>Prediction:</b> Because of student networks, this innovation will reach critical mass (15-20% of population) amongst students sometime during the fall semester 2009. After which time it is will spread through the rest of the population with little effort.</p>                                                                                                                                                                                                                                                                                                     |