Abstract—We report new developments for wConnect, an action research project aimed at recruiting more women into computer and information science. A key outreach activity for wConnect has been high school workshops, where we deliver hands-on web programming experiences. Over the past three years we have fielded and evaluated 11 workshops; nine used a Bridgetools end-user platform and two used wProjects, a Drupal-based tool. We report design and evaluation of the new tool, including some evidence that it improves on the earlier tools. We also report on new features allowing teachers to design their own workshop projects.

Keywords-component; End-User Web Development; K-12 Education; Content Management Systems; Action Research

I. INTRODUCTION

Over the past two decades the proportion of women seeking education and careers in the computer and information sciences (CIS) has dropped dramatically [1]. Researchers concerned with this trend have investigated many factors that may contribute to the decline, for example the social context of learning [2]. Others have focused instead on interventions at the college level aimed at attracting women and other minorities (e.g., introductory projects that emphasize media [3]). This paper reports an effort aimed specifically at high school girls: workshops that introduce them to dynamic web development.

The high school workshops are an outreach activity of wConnect, an online community of women who support one another in their CIS education and career goals [3]. The workshops have been developed and fielded by undergraduate members of the community, typically conducted at a former high school of the workshop leader. In this paper we briefly introduce wConnect and its goals, the end-user tools we built to support the workshops, and early experiences fielding the workshops. This preliminary work has been reported in greater detail elsewhere [5][6]. The main body of this paper concerns how and why we have moved to a different web development tool for the workshops, along with reactions to the new tool from both student and teacher perspectives. We close by discussing current status, implications and future directions.

A. wConnect, A Developmental Learning Community

wConnect is a developmental learning community [7]; members with diverse levels of CIS interest and expertise interact and support one another in education and professional goals. The community includes high school girls who may not even (yet) be considering CIS education or careers; 1st and 2nd year undergraduates who have decided to pursue CIS education or are considering doing so; more advanced undergraduates in CIS majors; and female alumnae, graduate students, and other professionals working in the CIS field.

In the past three years, wConnect has developed through participatory action research [8]. A core team of undergraduate members has created an online community space and a number of associated online activities. The community space emerged over three different stages: a research prototype, a site that used the Facebook public API, and one built in Drupal; see [9] for a detailed design discussion of the wConnect online space.

In addition to interacting with and supporting one another in online activities, wConnect community members organize outreach events to engage with young women in middle and high school, as well as undergraduate women who have not yet developed an interest in CIS as part of their career goals. The work reported in this paper concerns one outreach activity that has been underway since project inception: hands-on high school workshops that introduce web development activities.

B. End-User Web Development as an Outreach Activity

A primary goal for wConnect is to engage and inspire young women who are not planning to pursue CIS education, to help them see how it might fit into their personal plans. One way wConnect pursues this goal is with high school workshops where girls create their own websites. We focus on web development (e.g., rather than robotics or media computation) because the web is a pervasive platform for data and services that can be recruited to serve many different real world interests. We also know from studies of the CLICK tool that nonprogrammers can create basic database-centric web applications with little training and background expertise [10][11].

To support the workshops we built a custom workspace in Bridgetools, a Java-based research toolkit that supports a range of fully interactive and web-based content objects [12]. At the top of Figure 1 is a screenshot of a Bridgetools workspace. Users can open and edit a database (upper right), one or more queries (middle), and web pages (left). At any point these objects can be opened and used in a browser (lower left).

The high school girls create dynamic web applications: web pages that update dynamically as a function of changes to a
database and/or queries submitted to that database. Our goal has been to convey how a web page can be a “viewer” for a set of stored data. Thus the young women were introduced to the basic concepts of stored information (records in a database), queries that extract subsets of the stored information, and web pages that present the results of queries. They learned these concepts by adding, editing and deleting their own records and creating queries against the records. The web page editor uses a special tag for embedding a named query and dynamically rendered query results as part of a page. In Figure 1 the student has stored information about universities she was investigating; the page lists all of her findings that are in Pennsylvania.

In the past three years we have conducted nine workshops using the Bridgetools workspace; five were held in university classrooms and four at area high schools. All workshops lasted from 60-90 minutes, during which the students learned to use the tools, generating tables of data, queries and associated web pages. As reported elsewhere [5][6], workshop outcomes were promising, with most students enthusiastic about their web project creations and demonstrating basic comprehension of the database, query and web display concepts.

The Bridgetools infrastructure enabled us to quickly assemble a workspace that could be used for personal web development projects. However, as articulated in [13], we came to recognize that the Bridgetool approach is not sustainable as an outreach platform for the wConnect community. For Bridgetools workshops that occurred in school settings, we regularly experienced technical problems: some school networks had firewalls blocking access to the research lab server hosting these tools; others had workstations with out-dated versions of Java or Java WebStart. Even when the activity ran as intended, preparation for each session was complex and tedious for the wConnect team, requiring a number of Bridgetools objects to be created and initialized for each participant (e.g., see the left side of workspace in Figure 1). These problems have limited the dissemination of the workshop concept to teachers and other interested parties. Further, Bridgetools is complex and wConnect members do not have the skills to debug or extend it when needed. Because dissemination and long-term sustainability are central project goals for wConnect, it became critical for us to develop a more generalizable set of end-user tools for use in the workshops.

II. wPROJECTS

As we began work on a new tool for the workshops, several issues were foremost. Because of parallel work developing an online community space, wConnect members had built a body of expertise with Drupal and its open source community. Drupal runs reliably on most web browsers without advance work or testing in school classrooms. Although the platform constrains designers to generic web forms interaction (versus Bridgetools’ object-specific editors), this user interface style has become familiar to general web users. All of these issues made Drupal an attractive option for wConnect [13].

Prior to beginning Drupal development, we confirmed that the content management system would support our basic pedagogical goals: adding, editing and deleting records, creating queries against the records, and finally building a website that uses both static data as well as the dynamic data delivered through their queries. As a bonus, we expected that Drupal’s large open source community could be leveraged to help in dissemination and long-term maintenance of the tool. Finally, because Drupal is a web application itself, the issues of access to our servers and installation of software can be eliminated; all that the high school students need is an account, access to the internet, and no blocking of our tool’s URL.

As we built the Drupal-based authoring tool (we call the new tool wProjects) we found that in addition to addressing many of our concerns about Bridgetools, Drupal brings the benefit that any authorized user can design and specify their own workshop web project using the same forms-based interface provided for student projects. This adds to the impact and generalizability of wProjects because it expands the target population of end users to be not only students learners but also teachers, mentors or other educators. A characterization of a teacher “web project design” scenario was shared in [13]; here we add to this with some early teacher-user experiences.

The core of wProjects is a set of custom modules that work with a MySQL database (part of the Drupal platform) to 1) gather and store specifications for a project (e.g., the number and structure of the data tables it requires); and 2) store and manipulate instances of projects generated by students (e.g., records, queries, web pages). The custom modules follow Drupal community standards, they are written in Php and use the Drupal API. Each module handles one basic task within wProjects: project specification (i.e., for a workshop leader); project instantiation (i.e., for a workshop participant); input, editing and deleting of table records; query creation and editing; and page creation and editing.

Figure 2 depicts the pieces of wProjects used by Sally (a pseudonym for one recent participant) to add records to a table, create a query, and work with saved queries. In a) Sally created her table by making multiple passes through a web-forms dialog that presents one form for each field in a table named “Careers”. The parameters of the table – name, number and names of fields, and brief prompts to guide user input – have
been pre-specified by the web project designer. In this Careers and Majors project, girls are guided to explore web-based resources related to careers and majors, collecting pairings of varying interest in the table. At any point, Sally can use the Query tab to navigate to forms designed for specifying and previewing queries on her data table. For example in b) she has used a drop-down menu to select the “Interest” field and enter the string “High” as an includes criterion; when she presses the Preview button, the query will be applied and she will see what if any data are retrieved from her table. If she is satisfied with the result, she can c) name and save her query for later use. Sally can build as many queries as she likes.

Also at any point, Sally can use the Web Page tab to start working on web pages for her project (Figure 3). Once she has created one page she can return to edit that page further or create new pages. In either case she uses a version of an open-source HTML editor that we extended to support query content (fckeditor). This editor provides standard functionality for web page editing, including the option to work directly with the HTML source. For the Careers and Majors project we also pre-fetched evocative images but invited girls to find or generate content that they like.

The key connection between the web page and the database is the integration of query objects. We offer a simple selection dialog: users can press the customized query icon and to see a pop-up menu of saved queries. So, when Sally chose her saved High Interest query, High Interest was added at the text insertion point (a). When a web page is saved and opened, the query results are gathered and rendered as a table using the current Drupal theme (b). Girls are invited to change their page themes as desired; the wProjects designers have developed a small set to choose from, including a “vanilla” theme of black text on white (not surprisingly, no girls used that theme!). Once Sally has a data table, queries, and web pages, she can move flexibly among them, editing, adding and building connections as desired. In her case, she decided to insert five queries one after the other on one page. The work is saved for the participant in case she returns to wProjects for further work on this or other projects in the repository.

The implementation of wProjects is fairly straightforward because it reuses and extends existing Drupal modules. As stated earlier, the core concept is to store a project designer’s specifications (along with meta-data about the owner, date of
creation, etc.) as a MySQL record. Each time a project is instantiated, the pre-specified “tables” and “fields” are set up in another database table, this time with meta-data that connects the project to the student’s wProjects ID. As data are added, they are stored in this project-specific table. When queries are specified, the conditions are stored along with the user data and the table to which the query is directed. Web pages are standard nodes in the Drupal implementation, with information about who, when, and for which project they were created. The query extension to fckeditor was modeled on the Bridgetools editor, with the exception that we added a menu icon to simplify the user interface. We turn now to students’ and teachers’ reactions to the wProjects web projects tool.

III. STUDENT REACTIONS

We recently conducted two workshops using wProjects, the first in a classroom in our university (participants were from a local high school) and the second in a rural high school in our region. Nine girls participated in the first, ranging from 9th through 11th grade; eight were in the second, ranging from 9th through 12th grade. Of the 17, one had been exposed to some programming in a summer camp, but none had taken a high school programming course. For a 4-item CIS efficacy scale excerpted from prior work [14] (Cronbach α=.78 for these 17 girls), the mean was 4.1 on a 7-point scale – right at the neutral value. The girls were recruited by a teacher contact at each school and completed a short background survey as part of their application and informed consent.

Both workshops presented the “Careers & Majors” project. The workshop leader (a different one at each site) introduced the project concept and web resources useful for investigating career interests, and the wConnect project leader made brief comments about our own College’s undergraduate programs. The remaining time was spent on project development in three subtasks – table editing; query formulation; and web page editing. For each subtask, the leader demonstrated the process first, then the girls were given time to explore on their own. Interaction among the girls was encouraged as they searched for information, images or other content for their pages. The first workshop was time-limited as the girls had to catch a bus back to their school (about 50 minutes); in the second more time was available (about 90 minutes). The workshop closed with a take-home sheet about the wConnect community and future work with wProjects, and a brief feedback survey.

The feedback survey included the four reaction ratings that had also been used in earlier Bridgetools workshops. One probed the girl’s understanding of the web project goals; a second her feelings of success in completing it; a third how much fun she had; and a fourth how encouraged she felt about career interests (e.g., “I enjoyed looking at all the different careers and what they require. I also liked being able to keep track of them in a nifty table. I’ll be using this :).”). Others focused more directly on the tool and the experience of building personal web projects (e.g., “Because its very creative and fun to put your ideas in something like a website”). These

![Figure 4. Ratings contrasts for Bridgetools versus wProjects.](image)

It is important to emphasize that these quantitative contrasts are of an exploratory nature. We did not set up an experimental test of the two tools but rather took advantage of similarities in the two situations to draw a preliminary contrast. For instance, it is possible that the different project focus contributed to differences in the two sets of reactions. Nonetheless, these initial results are at the least suggestive that not only is wProjects meeting our higher-level wConnect requirements, but may be an improvement over the former tool.

Other data collected from the high school girls provides further evidence that the new wProjects tool is meeting our needs. The girls added from 3-7 records in their Career table (median 4); composed from 1-10 queries (median 2); and made from 1-3 web pages (median 1). Not surprisingly given the longer amount of time (90 rather than 50 minutes), the girls in the second workshop created more records and queries.

In addition to rating scales and simple production measures, we asked several open-ended questions, including explanations of the ratings for fun and feeling encouraged and things they liked most or least about the activity. The girls who worked with wProjects emphasized how the tool let them work with career interests (e.g., “I enjoyed looking at all the different careers and what they require. I also liked being able to keep track of them in a nifty table. I’ll be using this :”). Others focused more directly on the tool and the experience of building personal web projects (e.g., “Because its very creative and fun to put your ideas in something like a website”). These
comments are just what we hoped to see, that the girls liked working with the tools and that they also felt a personal connection to their project content. At the same time, some girls are simply not interested in web development, even if they enjoyed the single session with us (e.g., “I’m not into this sort of thing after I explored it”). Of particular interest given our decision to change tool direction, one girl from the Bridgetools workshop raised tool access as an issue, “The idea is cool to think about but I don’t have the software to continue”.

As a simple indicator of comprehension we included two probes about queries. One presented a hypothetical task of creating two web pages with different table content and asked how to do it. 10 of the 17 girls gave the right answer: create two queries, two web pages, and add one query to each. Six other girls were partially correct, some emphasizing web pages and others the queries. One said she did not know. A second question described updates to a table of data and asked what would happen if the page with the query were refreshed. 14 of the 17 correctly replied that the page would display the changed data; two incorrectly stated there would be no change and the final said she did not know. These results suggest that most but not all of the participants grasped the key concepts of query creation and use, including dynamic updates.

We also presented a simple “transfer” question, asking the girls to suggest other uses for a tool such as wProjects. All but one offered their own ideas, although several were variations on the college exploration theme. Other suggestions included a father’s business data; book reading and associated notes; class schedules; recipes; places they visit; vocabulary notecards; grades; and other websites in general. These responses indicate that most girls understood the web project concept enough to apply it to other personal interests.

Finally, to help explain the range in subjective reactions, we repeated an analysis conducted with earlier workshop data [6], documenting the relationship of individual differences on a composite of the four workshop ratings. We used the entire set of 33 participants and created indices for computer playfulness [15], CIS career orientation [14], and workshop positivity. After first ensuring construct reliability, we regressed workshop positivity on playfulness and career ID. The resulting model accounted for 33.6% of the variance in positivity (F(1,31)=8.1, p<.01) and showed strong effects of both variables (β values were .45 and .36). This simple regression confirmed the pattern seen in our earlier work: pre-existing positivity about CIS careers, and intrinsic enjoyment when using computers are independent and important predictors of girls’ reactions to the web development projects [6].

We invited seven teachers with whom we had collaborated in some way in the past to participate. Two were from middle school and five from high school; four were male and three were female. In the end, five teachers (two males, three females) tried out the wProject design features and completed a brief feedback survey. They worked with the tool at their convenience, in response to an email invitation that contained an overview document (containing an example use of the tool) and links to the tool and the online feedback survey.

Although all five participants completed the feedback survey, only three of them (the females) completed an actual project specification. One project was aimed at exploring goals students have set in a learning enrichment program; a second was information about a novel programming tool the teacher has been investigating; the third was for tracking reactions and ratings to books read during independent study. One of the other teachers believed he had created a project (but he did not describe its goals); the other said he only got as far as thinking about the web page.

Not surprisingly, the teachers who successfully specified a project were quite positive about their experience. On a scale from 0-10, with 0=Never and 10=Many Times, they each chose “8” as their likelihood of using the tool again. The other two teachers both entered values of “3”. They found the experience somewhat confusing, the tool not very easy to use, and the overview document lacking in useful examples. In contrast the three who created projects reported that the tool was quite easy to use and is likely to be useful by others (e.g., “I think it is a great way quickly set up a project. I think others will be able to adapt and use it to meet their needs” or “I’d like to follow the project so that I can use it in my classroom”).

With respect to concerns, several teachers expressed confusion about how to “test” their projects. In wProjects this is done by returning to the home page and choosing to “Create a Website” – the new project is now listed along with those specified by others. However this requires a designer to change mindset from that of a project designer to that of a project user (learner); we plan to add a short-cut to a project creation dialog for new projects as soon as they are saved. Two of the teachers also commented on the rigidity of the dialog: we use Drupal’s database in a simple fashion to record the specifications as they are input and it is not possible to revise a project once a table has been specified (e.g., change its name or structure). We are working to find a more flexible solution for this.

Finally, several teachers felt that the overview and/or the tool itself would be more useful if a larger number and more diverse examples were included. This desire for more examples is consistent with other studies of end-user programming by

### TABLE 1. CONSTRUCTS USED IN INDIVIDUAL DIFFERENCE REGRESSION

<table>
<thead>
<tr>
<th>Playfulness (7 items, α=.84)</th>
<th>Career ID (3 items, α=.88)</th>
<th>Positivity (4 items, α=.83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 (SD=.87)</td>
<td>4.3 (SD=1.0)</td>
<td>4.3 (SD=.67)</td>
</tr>
</tbody>
</table>

Note: scales ranged from 1-7 for Playfulness and Career ID, 1-5 for Positivity.

### IV. TEACHER REACTIONS

In parallel with the two workshops using the Careers and Majors project (specified by wConnect members), we sought preliminary feedback from teachers who attempted to use the project specification features of wProjects. Recall that any authorized user can specify a project concept – this involves choosing a project name, writing a brief description of the learning goals, and deciding how many tables and what characteristics are needed in the database. In addition to field labels for table columns, the project designer also provides a prompt that will be associated with each input field to guide the eventual user (e.g., “Type your level of interest, for example High, Medium or Low”).

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Finally, several teachers felt that the overview and/or the tool itself would be more useful if a larger number and more diverse examples were included. This desire for more examples is consistent with other studies of end-user programming by
teachers [16]. Adding more to the overview works against our general commitment to minimalist instruction [17], so we are hesitant to expand that document. However as wProjects goes into use more generally, many examples will be available.

As this summary conveys, our initial feedback from teachers was mixed. For the three teachers who grasped the concept, wProjects worked well; for other two it seemed mysterious and hard to use. Without a larger group of teachers and further probing it is unclear what might have led to these contrasting reactions. We hesitate to suggest gender-related explanations given the small sample size. However the teachers’ pedagogical orientation may have contributed – for example, one of the women is an enrichment teacher, another is an award winning technology innovator, and the third is a high school AP computer science teacher who is exploring novel ways to attract rural students into computing. In contrast the two men were more conventional educators, one teaching business technology courses and the other advanced chemistry. Regardless, we should either target a more specific teacher-user population or revise the tool to better meet the expectations and needs of all teachers. One simple direction to consider is to first invite the teachers to take on a “student” persona, doing concrete work with a sample project. In fact this is a better example of active learning [17], and might do a better job of orienting and motivation teacher-designers than our carefully written overview document.

V. DISCUSSION

The wProjects tool mitigates many issues we encountered when using Bridgetools: it can be accessed by anyone with Internet access, it leverages a large and active open source community, as well as a growing wConnect expertise, and it presents a simple and familiar web-forms interface. As a side benefit, workshop projects can now be created by any educator or mentor with an appropriately authorized wProjects account. Our initial trial suggests that the student outcomes are at the least equivalent and possibly better than what we achieved with Bridgetools. The teacher usage experiences were mixed but also hold promising signs that educators will be able to design wProjects activities useful for their teaching. We turn now to several new or ongoing issues raised by this research.

A. Tradeoffs in End-User Web Development Tools

Although wProjects seems to address our goals for broader dissemination and use of the workshop concept, the use of a Drupal platform has downsides. For instance, supporting end-user creation of web projects as part of a broad-featured CMS may not be the best way to communicate to learners that they are creating their own unique web applications. Although learners create personal content, their projects function as pieces of the encompassing wProjects application, borrowing its user interface themes and modules. In Bridgetools there was a cleaner distinction between the editing tools (i.e., the Java workspace) and the web application (opened and used in a distinct web browser). Although this is a genuine difference in the two approaches, wProjects users seem unconcerned, perhaps because they have no real concept of what “counts” as an independent web application. Nonetheless, we are working to increase the conceptual separation between wProjects and the websites it is used to create; one simple step is to store project URLs and make them accessible from outside the wProjects tool. This may be particularly attractive to students who want to show off their projects to friends or family.

With respect to dissemination and adoption by others, we have improved our position: anyone with a web browser and a wProjects account can design and/or create web projects, and any organization willing to install and maintain a Drupal server can create their own version or adaptation of wProjects. Nonetheless, installation and maintenance of the Drupal server is a cost that not all organizations (e.g., public schools) can bear, so our departmental server may end up hosting many projects if wProjects is successful and adopted widely; this may be an internal maintenance issue for us at some future date. Additionally, wProjects is linked to the Drupal community and the wConnect team must keep the modules up to date as future releases are made available; currently this is not an issue as community members have the expertise to handle the updates. Over time however wConnect may lose its “Drupal experts” causing problems for future maintenance. Finally, like any web-based application, wProjects must be regularly tested and updated as new web browsers are released.

Our reuse of Drupal base functionality such as input forms has speeded development of wProjects, but has also produced a tabs and web-forms interface that we view as tedious, even while it is familiar to most web users. We would like to explore other input and output options, perhaps by finding or building tools analogous to tekeditor but optimized for creation or editing of tables and queries (e.g., the spreadsheet-like data editor and query wizards built for CLICK). In his dissertation work, Park is investigating a rather different paradigm for web development by novices, one that relies on a simplified approach to HTML and CSS [18][19]. Although this research is aimed at a somewhat different user population and goals, we will follow his progress into tool design carefully to see if we can build from his ideas or tool components.

B. End-User Web Development as an Outreach Activity

In general, the workshops conducted by wConnect have been successful: participants have enjoyed the activities and most seemed to grasp the general concepts of data tables, queries, and dynamic web pages. At the same time, the web projects did not appeal equally to all girls – they were most effective for girls who arrived with a pre-existing identification with CIS, or a personal orientation of playfulness when using computers. One question as we continue is whether we can organize activities that are highly attractive to girls without these characteristics. For example, we may want to expand wConnect’s outreach repertoire to activities other than web programming, perhaps media manipulation activities similar to those explored by Guzdial and his colleagues [3].

It is also possible that characteristics of the tools made the web programming less attractive to some girls. Beckwith and her colleagues [20] have made arguments of this sort in the context of spreadsheet debugging. Because of the outreach workshop format, it has not been possible to analyze the girls’ use of the tools in detail and to see whether they are experiencing problems tied to their individual characteristics.
We also recognize that while the girls succeeded in building the dynamic web projects and many were able to answer questions about queries and updates in the feedback survey, we do not really know how much they learned (especially in any long-term sense) from their workshop experiences. If they went back to wProjects and started a different project, would they be able to succeed? We suspect so, but cannot be certain without further testing. Given many girls’ readiness to suggest other application ideas, we are also curious to see whether and how well a high school girl can specify her own web project.

One disappointment is the relative lack of follow-through by participants. A few have joined wConnect, but do not attend online activities, contribute content, and so on. The wConnect team has been brainstorming ways to extend the engagement with these young women, for instance inviting a group of girls to help in mentoring another group. The general appreciation of the Careers and Majors project points to another idea – create web projects that are useful in and of themselves, so that girls may return to expand and use them.

C. Teachers as Web Project Designers

Although we obtained mixed feedback, we are encouraged by our early experiences with teachers designing new projects. For now, we will recruit teachers known for their technology innovation and education outreach, working with them to improve the project design dialog and documentation. One point we have already grasped is that most educators will not be motivated simply by the desire to teach students about dynamic web applications. Although this is the specific goal of the wConnect workshops, teachers working within their own context will have their own teaching goals. They may be perfectly content for the students to learn some web programming along the way, but their focus will be on science, literature or whatever content subject they teach.

We also need to learn more about the problems of the teachers who aborted their projects. One way to do this is to bring teachers in as lab study participants, where we can observe their efforts and reactions more closely. Another is to advertise wProjects more broadly but make its use contingent on completing a more detailed survey afterwards, or an interview where we can probe individual differences among users that might be leading to differential experiences.

VI. CONCLUSION

wProjects appears to be a reliable and useful tool, but we have many enrichments planned. In addition to improving the web-forms user experience, wConnect members are creating a module that will allow designers to see all of the learners who complete their projects and other associated data. We are also planning to allow collaboration across wProjects, so users can see and potentially merge with other users’ content, creating queries for a richer dataset. We are also eager to integrate wProjects and its users into the online community, giving users the option to share their projects with others. Once we do this, we hope to use wProjects in a more direct and pervasive fashion to attract and engage young women in CIS activities.

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REFERENCES