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# **Evolving Patterns of Household Computer Use: 1999-2010**

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## **INTRODUCTION**

Computer ownership has increased dramatically over the past 10 years. At the beginning of the 2000's, 51 percent of homes had a personal computer and 42% had Internet access [U.S. Census Bureau, 2000]. By 2009, nearly 70% of U.S. households were estimated to be using the Internet at home [U.S. Census Bureau, 2009]. That the personal computer has become an integral part of a large number of households is apparent. And, as computers have become integrated into the household and use has spread across family members, this technology is expected to make and, in a number of households, has already made fundamental changes in household activities and the performance of household tasks.

In many households, the personal computer has become a multi-purpose appliance integrated into many of the routine activities of a household. In the 1980's, home computers were primarily used for work at home, for adult and child education, and for entertainment (Vitalari and Venkatesh, 1987). With the advent of the Internet in the mid-90's, researchers found that home computing spread to additional activity areas (Venkatesh, 1996). Indeed, some researchers have argued that in many households the Internet has become indispensable [Hoffman et al., 2004]. Interpersonal communication through email and other networking applications is a primary computer use in the home (Kraut et al, 1998). In addition, information-seeking, including news, sports, product, health, how-to's and the myriad of other needs for information through computer searches has become second nature for many home users (Rieh, 2004). It has also been noted that online shopping has continued to increase year-by year (Wolfenbarger and Gilly, 2001), as well as online banking and other financial management tools (Fox and Beier, 2006). Growth in computer use in the home has thus spread to include many activities within the home.

While research has been done on the spread of automated activities in the home, little research has addressed the issue of the extent to which computer use has contributed to the total performance of these activities. For example, to what extent does the computer contribute overall to interpersonal communication activities of household members? Has the computer supplanted other means of communication among family members and friends or is it simply an additional means of keeping in touch?

The extent to which the PC and its applications/uses have grown over the past decade and the current perceived contribution of the computer within each activity area is the focus of this report. Data from

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surveys taken in 1999, 2003, 2008 and 2010 will be used to measure the change in the diffusion of computer uses within household activities. Then, a description of major computer uses within each activity in 2010 will be presented. Finally, an assessment of households in the extent to which computers have contributed to each activity area will be presented.

## **METHODS**

Data from national surveys of home computer use completed in 1999, 2003, 2008 and 2010 are used in this report.<sup>2</sup> The surveys are part of a larger study of personal computer use conducted by researchers at the Center for Research on Information Technology and Organizations (CRITO) located at the University of California, Irvine. These telephone surveys focused only on those households where there was a personal computer in use in the home. The households were selected through random digit dialing. All those within a household who were knowledgeable about the household computer use and were over the age of 18 were eligible. Respondents reported on their own behavior as well as the behavior of other members in the household. They were asked about the use of the home computer, their attitudes regarding the home computer, other electronic devices in the household as well as the contribution of the home computer to the household activities. The 2010 survey also included a section on the uses of cell phones. A separate sample of cell phone only users was included in the 2010 survey.

We define “households” as American households with at least one computer in the home. In Table 1 on the next page, both household level and respondent level characteristics are displayed. The distributions are compared with U.S. Census American Community Survey population estimates. Given the sampling requirement of computer ownership, the households are, in general, more educated and of a higher socioeconomic status than the average American household. In addition, there are fewer single person households than what would be expected. One interesting characteristic of the demographics over time is the increase in respondents over the age of 60 over the 10 year period as the percent of households with a personal computer increased.

We focus on how personal computers are used within the household. *Use* is measured by the response to a single item: Does anyone in the household use the home computer for this purpose (a certain home computer activity, such as email or education/learning)? A total of 13 computer-using activities were asked: email; online networking; news, weather, sports or other information; health-related information; information about products and services online; online shopping, that is, buying a product or service online; travel and vacation planning; hobbies, games and entertainment; uploading and/or downloading photographs, videos or music; job-related work; school-related work including adult education; online banking, bill paying and other financial transaction; and calendaring.

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<sup>2</sup> The 1999 survey was conducted as part of Project NOAH (National Outlook for Automation in the Home); 910 households were interviewed by telephone with a response rate of 36.3%. The 2003 and 2008 surveys were conducted as part of Project POINT (People, Organizations and Information Technology); 1200 telephone interviews were completed for each survey with response rates of 44.3% (2003) and 26.2% (2008). The 2010 survey (also part of Project POINT) sampled both landline and cell phone only households with response rates of 24.1% for the cell phone only sample and 30.7% for the landline sample (landline sample also included cell phone users).

Table 1. Household and Respondent Characteristics of Surveys

	UC Irvine NOAH and POINT Surveys				U.S. Census Bureau American Community Survey <sup>a</sup>		
	1999	2003	2008	2010	2003	2005	2009
<b>Household characteristics</b>							
<i>Household income</i>	%	%	%	%	%	%	%
Under \$30,000	16.4	12.3	10.7	18.2	34.2	32.5	30.2
Between \$30,000 and \$50,000	25.9	17.1	16.9	20.8	21.8	20.9	19.6
Between \$50,000 and \$75,000	24.7	24.6	24.9	21.3	19.1	18.9	18.3
Between \$75,000 and \$100,000	17.2	17.5	18.9	15.3	10.9	11.4	12.1
Over \$100,000	15.7	28.5	28.5	24.4	14.0	16.3	19.8
<i>Type of household</i>	%	%	%	%	%	%	%
Single person only	13.6	14.6	18.1	20.3	26.8	27.1	27.5
Adults only	42.2	45.3	50.2	46.5	37.8	38.0	39.0
Adults and children	44.3	40.1	31.7	33.2	35.4	34.9	33.5
<i>Size of household</i>							
Average size of household	2.96	2.88	2.70	2.66	2.61	2.60	2.63
<b>Respondent characteristics</b>							
<i>Gender</i>	%	%	%	%	%	%	%
Male	45.5	44.1	47.5	43.8	48.2	48.3	48.7
Female	54.5	55.9	52.5	56.2	51.8	51.7	51.3
<i>Age</i>	%	%	%	%	%	%	%
18-30	22.0	24.7	13.2	15.7	21.1	21.2	22.4
31-45	41.6	37.5	27.7	25.7	30.4	29.1	26.5
46-60	26.5	27.7	35.7	35.0	26.6	27.5	27.2
61 and older	10.0	10.0	23.5	23.6	21.9	22.2	23.9
<i>Education completed</i>	%	%	%	%	%	%	%
High school or less	20.2	14.3	17.3	20.8	46.2	45.3	43.2
1-2 years of college	33.3	27.2	28.9	27.7	27.3	27.5	28.9
College graduate	46.6	58.6	53.8	51.4	26.5	27.2	27.9

<sup>a</sup>Data obtained from tables available at <http://factfinder.census.gov/>

These computer uses were classified into seven household activities areas: communication, information-seeking, shopping/commerce, entertainment, job-related work, education/learning, and home management [Figure 1].

Figure 1. Household Activities



Table 2 provides the frequency of household use for the 13 activities over time. Very apparent in the table is the huge jump in use from 1999 to 2003 as the Internet became more common in homes. While in 1999, the use of the computer for hobbies, games and entertainment was the only use reported by over 80% of the households, by 2010, over 80% of the households reported using the home computer for 6 of these activities. On the other hand, the proportion of households using the home computer for some activities has remained fairly stable over the ten year period, most notably, job-related work and education/learning tasks.

Table 2. Uses of Home Computers, 1999-2010

	Percent Use				Percent Change			
	1999	2003	2008	2010	1999-2003	2003-2008	2008-2010	1999-2010
<i>Communication</i>								
Email	78	<b>95</b>	<b>96</b>	<b>98</b>	21.95	1.37	1.87	25.93
Online networking			44	76			71.40	
<i>Information seeking</i>								
News and sports	64	<b>80</b>	76	<b>89</b>	25.20	-4.15	16.27	39.53
Health-related information	46	77	<b>83</b>	<b>83</b>	67.25	8.09	-0.24	80.35
Products and services				<b>91</b>				
<i>Shopping/E-Commerce</i>								
Online shopping	52	77	<b>80</b>	<b>85</b>	47.78	3.91	6.15	63.01
Travel and vacation planning	55	<b>82</b>	72	78	49.91	-12.44	8.08	41.86
<i>Entertainment</i>								
Hobbies, games and entertainment	<b>86</b>	<b>88</b>	<b>87</b>	<b>84</b>	2.45	-0.57	-4.12	-2.331
Upload photographs and videos		55	76	<b>84</b>		39.01	11.07	
<i>Job-related work</i>								
Job-related work	71	72	63	66	1.69	-12.19	4.10	-7.04
<i>Education/Learning</i>								
Education/Learning	59	47	46	63	-20.13	-2.75	36.38	5.92
<i>Home management</i>								
Online banking	31	60	67	77	96.73	10.80	14.84	150.33
Calendar		38	39	46		0.26	18.70	

We also examine the extent to which the home computer *contributes* to each activity and household activity area. Here, we ask respondents to assess how much the computer contributes to the seven household activity areas. By asking them to consider activities that can be done either with or without a computer; we are able to begin to measure the extent to which the computer in the home contributes overall to the activity. The exact wording was: “We are also interested in the importance of a computer in everyday life. In most households there are a number of activities that are done both with and without a computer. Thinking about each household activity as a whole, how much does a computer contribute to the following activities in your home. Would you say it contributes, not at all, a little, some or a great deal?” These questions were asked only in the 2008 and 2010 surveys. We find the highest levels of contribution are reported for communication with over 70% reporting that the home computer contributes at least “some” to communicating with friends and relatives. Acquiring information via the home computer is perceived by two-thirds of the households as contributing at least ‘some’ to information-seeking. On the other hand, significantly fewer households perceive the computer as contributing highly to such activities as home management and shopping.

Table 3. Computer Contribution to Household Activity Areas

Household Activity Areas	Percent indicating that the home computer contributes 'some' to 'a great deal' to household activity	
	2008	2010
Communication	71.6	70.8
Information		
Information	n.a.	66.7
Health	32.8	45.7
Shopping/E-Commerce		
Shopping	45.3	55.2
Travel	51.8	56.5
Entertainment	52.3	56.3
Job-related Work	45.8	53.3
Education/Learning	58.0	59.6
Home Management	46.4	50.9

While it is interesting to note the degree to which households are using home computers for different kinds of household activities as well as the assessment of the degree to which these computers contribute to centers of activity in a household, it is more than likely the case that household characteristics most likely play a part in both the use and contribution of household personal computers. We have identified three *household demographic measures* which we believe may moderate a household's responses – education, income and type of household. Level of education may play a differentiating part in the number of activities that are automated in the household. There is a general assumption that the level of education in the household may affect the household member's overall pattern of computer use and technology consumption. To test for this effect, computer activity and contribution will be broken down by education level. Household education level will be measured as the highest level of education of all of the members of the household. Income level is another factor that may influence the extent to which home activities are automated. Early adoption of computers in the home was differentiated by income level with those in higher income levels more likely to have a computer in the home than those with lower incomes due to the high cost of home computers. The cost of computers has dropped precipitously making it affordable to own a home computer. However, a residual effect may exist in the amount of experience a household has had with a computer in the home by income level. Household income is measured by the response to the question: "And, while I don't need the exact amount, please tell me whether your total annual household income is: \$15,000 and under, \$15,000-\$30,000, \$30,000-\$50,000, \$50,000-\$75,000, \$75,000-\$100,000, more than \$100,000. Income in this report has been classified into three categories: under \$50,000, \$50,000-\$100,000, and more than \$100,000.

Another characteristic of the household that may play a part in the degree of computer use and contribution is the type of household. Both the number of people within a household as well as the presence of children in the household can be considered as adding to the complexity of the household. This complexity may increase the need for automating some household activities to keep track of household members and their schedules as well as incorporating computer use for other activities as a way of providing additional efficiency for managing the household. Also, the level of activity within households will vary depending on the sheer number of household members or the needs of household members. For example, the presence of children will increase the 'learning' element of the household

while a single person household may have far less need in that area. Online banking and online shopping may be more of a necessity for households with children where it is more difficult to find the time to head out to the bank or the mall. Household type will be measured as one of three types: single person household, adults only household, and households with children.

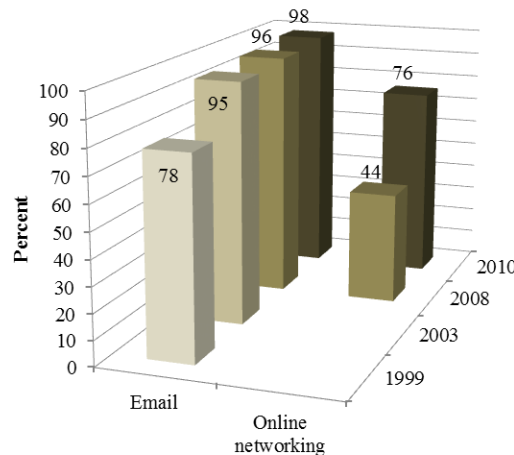
## FINDINGS

In this section, we will discuss the seven types of household activities separately by first describing representative computer-related uses within each activity area, then breaking down the uses by household education, income and household type, and finally assessing the contribution of the household computer uses in each activity area. We will also consider the association of education, income and household type in terms of contribution to household activities. In the final section, we will consider the relative impact of the personal computer to household activities.

### Communication Activities

Key types of computer uses common to household communication activities are email and online networking. Over time, both of these applications have increased in the proportion of households that are using these types of electronic communication [Figure 2]. By 2010 email is nearly universally used. Over the 10 year period, the rate of change has been 33% with the major jump occurring between 1999 and 2003 (rate of change was 29%). In addition, online networking is becoming a popular method of communication in households with 76% of the households reporting online networking activity in 2010. In just 2 years (2008-2010) the growth rate has been a whopping 73%.

Figure 2. Household Electronic Communication Uses, 1999 - 2010



Given that e-mail has become ubiquitous in American households, it is not surprising that households are not distinguishable in this type of use. Regardless of type of household, be it a single person, an adult only household, or a household with children, no significant differences are seen in terms of e-mail use. Similarly, no significant percentage differences are seen in terms of household education level and household income level [Table 4].

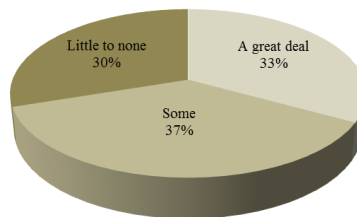
Table 4. Email and Online Networking: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
% email	96.6 (144)	98.7 (546)	97.9 (470)	95.9 (213)	96.9 (311)	99.5 (634)	97.0 (426)	98.7 (367)	100.0 (213)
	$X^2=3.025, p=.220$			$X^2=15.323, p=.000$			$X^2=7.862, p=.020$		
% online networking	59.1 (88)	72.5 (400)	86.7 (416)	73.4 (163)	74.7 (239)	78.6 (499)	77.2 (339)	75.2 (279)	81.0 (171)
	$X^2=57.883, p=.000$			$X^2=3.289, p=.193$			$X^2=2.614, p=.271$		

Social networking sites, such as Facebook, MySpace and LinkedIn are another popular computer-based communication use in American households. These online communities provide users with links to others to share information and ideas, or just to keep in touch. By 2010, 76% of computer using households reported using the computer to access social networking sites. While using email was uniform across different household types, communication through social networking sites is distinguishable. Households with children under 18 were most likely to use social networking sites, as 87% of households reported their use. Adult only households were also using online networking in high amounts, with 73% of households reporting their use. On the other hand, single person households lagged well behind, with just 59% of households reporting using home computers for online networking. While type of household differed in use, social networking sites can be seen as something of a socioeconomic equalizer in terms of computer use, as there were no differences seen between groups based on household education level or household income [Table 4].

While there is nearly universal use of computers for email and a high proportion of households also communicate with friends and family through social networking sites, the computer clearly has not completely replaced other forms of communication. Approximately one-third of households reported that the computer contributes “a great deal” to communication with friends and relatives, but at the same time roughly three-tenths reported that the computer provides little to no contribution to household communication [Figure 3].

Figure 3. Computer contribution to communication activities, 2010



Type of household does not differentiate those households which consider the home computer to contribute a great deal to household communication versus those who do not [Table 5]. Income and education are also not associated.

Table 5. Computer contribution to communication activities in the home: household type, education, and income, 2010

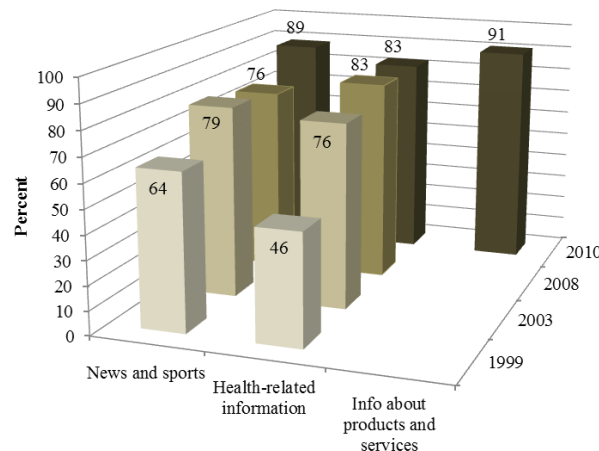
	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Little to none	29.3 (43)	29.6 (164)	30.2 (144)	35.9 (80)	29.7 (95)	27.5 (174)	27.0 (117)	30.1 (112)	31.0 (66)
Some	32.7 (48)	39.5 (219)	35.6 (170)	29.6 (66)	36.6 (117)	40.2 (254)	33.2 (144)	41.1 (153)	39.9 (85)
A great deal	38.1 (56)	30.9 (171)	34.2 (163)	34.5 (77)	33.8 (108)	32.3 (204)	39.9 (173)	28.8 (107)	29.1 (62)
	$X^2=4.095, p=.393$			$X^2=9.191, p=.057$			$X^2=13.811, p=.088$		

### Information Seeking Activities

Home computers are being used in 2010 to get news, weather, sports, or other information and to acquire health related information. The internet is often cited as the most integral tool for information seeking [Hoffman et al., 2004]. Any and all types of information is readily available as well as opinions on practically any topic. One can look up the weather in London, read the newspaper from the town you grew up in, check side effects of medication, read, as well as produce, opinion pieces on current issues, and check the latest sports scores with only a few mouse clicks. There are also resources available to organize and share information relevant to an individual or household.

Electronic information seeking has steadily increased over the last decade. With the advent of the Internet, the computer became an important tool for obtaining information. From 1999, use in this activity area jumped from about half of households to three-quarters of the households using computers for such areas as news and sports, as well as a vehicle for obtaining health-related information [Figure 4]. Since 2003, there has been a steady increase in the number of households using the computer for this purpose.

Figure 4. Household Electronic Information Seeking Uses, 1999 - 2010



In 2010, 89% of households reported using computers for news, weather, sports and other information. Even though the use of the home computer for this type of information seeking is high across all groups, households with children were significantly more likely than other household types to seek information on the internet [Table 6]. Fully 92% of households with children used the internet for obtaining ‘newspaper’ type information compared to 87% of adult only households and 85% of single person only households. Use of computers for news, weather, and sports was high among all education levels, but is reported to be highest among those households with a college degree. Ninety-two percent of households with advanced education reported seeking information online, compared to 85% of those with a high school diploma or less. The income level of the household is also associated with 94% of those households with incomes greater than \$100,000 reporting using the computer for this information in contrast to 85% of those households with less than \$50,000 total income.

Table 6. Information-seeking activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
% news, sports, weather, etc.	84.6 (126)	86.7 (483)	92.3 (443)	84.8 (189)	85.3 (273)	91.7 (587)	85.4 (374)	89.5 (333)	93.9 (199)
	X <sup>2</sup> =10.913, p=.004			X <sup>2</sup> =12.920, p=.002			X <sup>2</sup> =10.645, p=.005		
% health information	71.1 (106)	86.8 (480)	81.4 (390)	71.6 (159)	82.5 (264)	87.1 (553)	79.2 (347)	86.8 (321)	84.0 (178)
	X <sup>2</sup> =20.901, p=.000			X <sup>2</sup> =27.837, p=.000			X <sup>2</sup> =8.241, p=.016		
% products & services	89.3 (133)	92.6 (511)	90.4 (432)	83.3 (185)	88.1 (281)	95.6 (609)	84.0 (367)	96.0 (357)	95.8 (204)
	X <sup>2</sup> =2.407, p=.300			X <sup>2</sup> =36.572, p=.000			X <sup>2</sup> =42.532, p=.000		

Another type of information readily available through the Internet is health-related information. With the rise of websites like WebMD, more and more households are turning to the computer for information related to their health. Eighty-three percent of all households reported using the computer for health-related information in 2010. Significant differences are seen between different household types in terms of computer use for health-related information. Adult only households were significantly more likely to report using computers for health-related information (87%) compared to households with children (81%) and single person households (71%) [Table 6]. Households with higher levels of education also were more likely to use the computer to seek health-related information, compared to those with lower levels of education. Eighty-seven percent of households with college degrees or advanced degrees reported using the computer to find information related to health, while only 72% of those with a high school diploma or less reported the same. A similar pattern is seen with household income where those households with incomes of less than \$50,000 were less likely to seek health information on the computer than those with incomes greater than \$50,000.

Gathering information about products and services, both in terms of cost and characteristics, is a very important third type of information seeking used in households. Ninety-one percent of households in 2010 reported using their computer to obtain this type of information. While type of household is not related to using the computer for product and service information, both household income and education are related. Households containing college educated members as well as households with incomes greater

than \$50,000 are significantly more likely to turn to the computer for this type of information than other households.

Not only is information seeking one of the top computer use activities in 2010, roughly 34% of households also report that the home computer contributes “a great deal” to seeking of news, community activities and other information in the household. An additional one-third reported that the computer contributed “some” to information seeking [Figure 5]. On the other hand, while 83% of households reported using the computer to search for health-related information, only 11% reported that the computer contributes “a great deal” to their entire health-related activities indicating the home computer has not replaced other sources of health-related information, such as seeing a doctor [Figure 5].

Figure 5. Computer contribution to news, community activities and information and health-related activities, 2010



**News, community activities and information**

**Health-related activities**

Type of household does not have a bearing on the degree to which the computer contributes to the gaining of information, while level of education is associated. Households where there are college graduates are more likely to report that that computer contributes a great deal to information seeking activities in contrast to those households in which the members have a high school education or less. On the other hand, there is no association between household type, level of education and level of income in terms of the assessment of the degree to which the home computer contributes to health-related activities [Table 7].

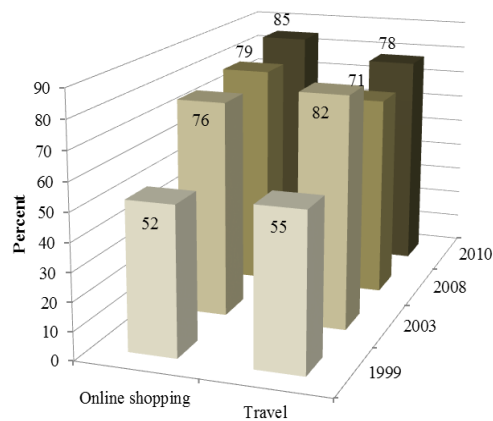
Table 7. Computer contribution to information activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
<b>News, community activities and information</b>									
Little to none	33.3 (49)	32.1 (178)	31.2 (149)	42.3 (94)	32.2 (103)	27.2 (172)	33.9 (147)	27.7 (103)	25.4 (54)
Some	31.3 (46)	36.8 (204)	31.8 (152)	25.7 (57)	35.6 (114)	36.9 (233)	32.3 (140)	37.9 (141)	33.3 (71)
A great deal	35.4 (52)	31.0 (172)	37.0 (177)	32 (71)	32.2 (103)	35.9 (227)	33.7 (146)	34.4 (128)	41.3 (88)
	$X^2=5.262, p=.261$			$X^2=19.453, p=.001$			$X^2=8.913, p=.063$		
<b>Health-related activities</b>									
Little to none	55.8 (82)	54.5 (301)	52.9 (250)	56.3 (125)	55.2 (176)	52.3 (328)	55.4 (240)	54.5 (201)	53.8 (114)
Some	32.7 (48)	35.5 (196)	36.4 (172)	31.1 (69)	34.2 (109)	37.8 (237)	33.0 (143)	35.5 (131)	38.7 (82)
A great deal	11.6 (17)	10.0 (55)	10.8 (51)	12.6 (28)	10.7 (34)	9.9 (62)	11.5 (50)	10.0 (37)	7.5 (16)
	$X^2=1.011, p=.908$			$X^2=4.086, p=.395$			$X^2=3.651, p=.455$		

### Shopping/Commerce Activities

Two important kinds of computer uses in terms of shopping and other commerce type activities in the home are buying a product or service online, and travel and vacation planning. While the proportion of households reporting these uses increased dramatically between 1999 and 2003, the amount of use has since leveled off from 2003 to 2010 [Figure 6].

Figure 6. Household Electronic Shopping/Commerce Uses, 1999 – 2010



Once a household has culled the necessary information about a product or service, a purchase can be made. More and more, these purchases are being made online, as 85% of households reported using the

internet for buying a product or service in 2010. Household education level is associated with purchasing a product or service online, while type of household does not differ [Table 8]. Households with higher levels of education were more likely to report online purchasing. Ninety-two percent of households with college degrees purchased products or services online compared to 72% of those households with high school diplomas or less. Not too surprising, household income level is associated with household use of the computer for purchasing products. While only 76% of those households with less than \$50,000 income reported online shopping, a full 90% of those with incomes between \$50,000 and \$100,000 and 93% of those with incomes over \$100,000 reported using the home computer to purchase products.

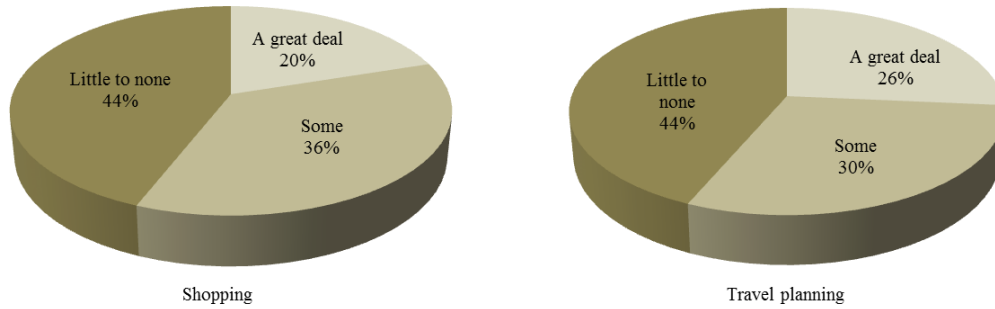
Table 8. Buy a product or service online: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
% online shopping	79.2 (118)	85.6 (474)	86.3 (414)	71.6 (159)	81.0 (260)	91.7 (584)	75.6 (332)	90.3 (336)	92.9 (197)
	X <sup>2</sup> =4.671, p=.097			X <sup>2</sup> =57.490, p=.000			X <sup>2</sup> =47.645, p=.000		
% travel planning	69.1 (103)	82.4 (453)	75.8 (364)	61.4 (137)	69.9 (223)	88.0 (559)	68.3 (300)	83.4 (307)	90.1 (192)
	X <sup>2</sup> =14.266, p=.001			X <sup>2</sup> =85.294, p=.000			X <sup>2</sup> =48.962, p=.000		

The plethora of travel sites on the internet have made it possible for the average household to plan and book their own vacations, from airplane reservations, to hotel rooms, to car rentals, to sight-seeing tours. In 2010, 78% of households reported using the computer to do some form of travel and vacation planning. Reliance on the internet for travel and vacation planning significantly differs among different types of households [Table 8]. Adults only households were more likely to do online booking while single person households are least likely (82% versus 69%). Again we find education and income to be associated with a higher likelihood that a household used the computer for travel planning. Eighty-eight percent of households with college graduates in contrast to just 61% of those with a high school diploma or less used the computer when planning travel and vacations. Similarly, only 68% of households with total income under \$50,000 in contrast to 90% with total income greater than \$100,000 reported using the home computer for travel and vacation planning.

While a high proportion of households are using the computer for online product/services shopping, the extent to which the computer is perceived to contribute a great deal to this type of household activity is much lower than what is found with communication and information [Figure 7]. Only 20% of the households reported that the home computer has contributed ‘a great deal’ to household shopping while fully 44% reported that it has contributed overall ‘little to none.’ Apparently households are willing to use computers to complete tasks in the shopping/commerce center, but only if it is convenient for them. The distribution for travel planning is similar to shopping although a slightly higher percentage of households reported that the computer contributed a great deal to vacation planning. However, in both cases, 44% of the households reported little to no contribution for these home commerce activities. There are alternative means for buying products and services and vacation planning that many households may still prefer, such as heading to the mall with a shopping list, or visiting a travel agent to book travel.

Figure 7. Computer contribution to shopping and travel planning activities, 2010



In the shopping/commerce household center, we see no differences between household types, but continue to find significant differences in terms of household education [Table 9]. Income level is also significantly associated with the degree to which the home computer is perceived to contribute to shopping. Households with more education and higher income tend to perceive more benefit from this type of computer use than households with lower levels of education and income. The degree to which the home computer contributes to vacation planning is associated with type of household, education and income. Single person households are slightly more likely than other types of households to consider computer assisted travel planning as contributing a great deal to this activity area. Interestingly they are also more likely to report that the computer contributes little to their travel planning. A much clearer pattern is shown with respect to education and income with higher levels of education and higher income more likely to rely on the computer for making travel plans and preparations.

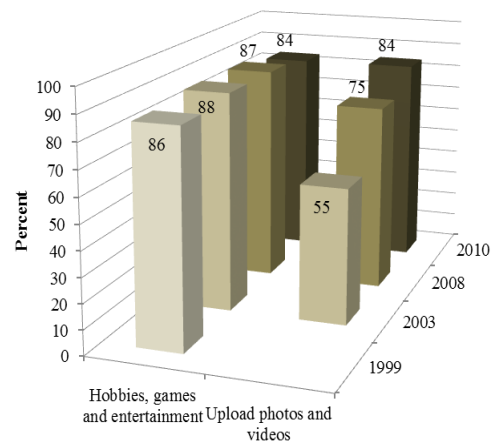
Table 9. Computer contribution to shopping and vacation planning activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
<b>Shopping</b>									
Little to none	53.7 (79)	43.2 (239)	41.8 (199)	59.5 (132)	51.6 (165)	34.5 (218)	53.0 (230)	38.8 (144)	31.9 (68)
Some	26.5 (39)	37.8 (209)	36.3 (173)	20.7 (46)	31.9 (102)	42.9 (271)	27.0 (117)	43.4 (161)	39.4 (84)
A great deal	19.7 (29)	19.0 (105)	21.8 (104)	19.8 (44)	16.6 (53)	22.5 (142)	20.0 (87)	17.8 (66)	28.6 (61)
	$X^2=9.009, p=.061$			$X^2=57.345, p=.000$			$X^2=41.715, p=.000$		
<b>Vacation planning</b>									
Little to none	51.4 (76)	39.7 (220)	44.7 (213)	53.8 (120)	53.9 (173)	33.7 (213)	50.7 (220)	41.2 (153)	27.7 (59)
Some	18.2 (27)	33.9 (188)	29.8 (142)	29.6 (66)	24.6 (79)	33.7 (213)	28.3 (123)	30.5 (113)	32.4 (69)
A great deal	30.4 (45)	26.4 (146)	25.6 (122)	16.6 (37)	21.5 (69)	32.6 (206)	21.0 (91)	28.3 (105)	39.9 (85)
	$X^2=14.647, p=.005$			$X^2=53.585, p=.000$			$X^2=37.495, p=.000$		

## Entertainment Activities

Two computer uses found within the home entertainment activity area are uses centering on hobbies, games and entertainment, as well as the uploading and downloading of pictures and videos [Venkatesh, 1996]. The use of the home computers for hobbies, games, and as a form of entertainment has been a mainstay since the introduction of personal computers in the home. Over the 10 year period, there has been little change in the percent of household reporting this type of use [Figure 8]. Roughly four-fifths of computer using households used the computer for entertainment. The use of the computer as a repository for photographs and videos, on the other hand, has shown huge growth in this time period. While in 2003, roughly 50% reported uploading/downloading photographs and videos, by 2008 three-quarters of the households were reporting this use.

Figure 8. Household Electronic Entertainment Uses, 1999 - 2010



Early home computers were largely viewed as game playing devices for many users and as such, were primarily adopted by young males (Mumtaz, 2001). Though the capabilities of computers may have expanded, many users still look to computers for their entertainment needs. Eighty-four percent of all households with a personal computer reported using their computers for hobbies, games and entertainment in 2010 [Figure 8]. Not surprisingly, households where children are present reported the highest levels of computer use for entertainment. 93% of households with children used computers for hobbies, games, and entertainment, compared to 81% of adult only households, and 69% of single person households [Table 10]. On the other hand, household education and household income were not associated with using the home computer for these purposes.

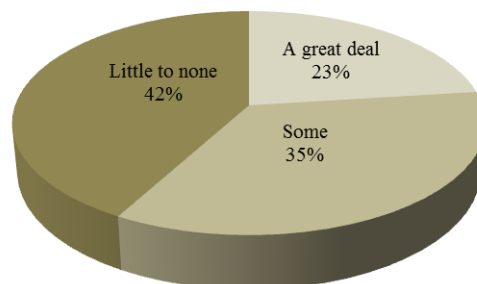
Table 10. Hobbies, games, and entertainment: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Hobbies, games & entertainment	68.5 (102)	81.4 (445)	92.5 (443)	82.1 (183)	85.6 (273)	84.3 (531)	86.2 (376)	83.5 (309)	85.2 (179)
	$X^2=55.961, p=.000$			$X^2=1.226, p=.542$			$X^2=1.176, p=.555$		
Upload/download photos & videos	72.5 (108)	83.0 (458)	90.8 (435)	77.1 (172)	82.4 (263)	88.7 (564)	82.2 (359)	86.6 (322)	91.9 (194)
	$X^2=32.463, p=.000$			$X^2=18.980, p=.000$			$X^2=11.477, p=.003$		

With the rise in sites like YouTube and iTunes, it is common for households to now consume a majority of their entertainment media online. Eighty-four percent of households reported using the computer to upload and/or download videos and photographs. Similar to the use of the household computer for hobbies, games and entertainment, households with children were most likely to report using computers for uploading and downloading media (91%), compared to adult only households (83%) and single person households (73%) [Table 10]. In addition, households with college degrees were more likely to report uploading and downloading entertainment in the home. Eighty-nine percent of those households with college degrees reported using the computer for this purpose, compared to 77% of those with a high school diploma or less. Total household income is also associated with photo management. Ninety-two percent of households with more than \$100,000 reported uploading and/or downloading photos and videos.

While computers are being used by a vast majority of computer households for home entertainment activities, the computer is not necessarily perceived to be making an equal contribution to this area. Respondents were asked how much the computer contributes to entertainment and hobby activities in the home. Only 23% of the households reported that the computer contributes a great deal to home entertainment and fully 42% reported that it contributes little to none in this area of home life [Figure 9].

Figure 9. Computer contribution to entertainment activities, 2010



No distinct differences between household types were found as single person households, adult only households, and households with children all reported similar perceived contribution [Table 11]. Both household educational level and income level were associated with the extent to which the home computer contributed to home entertainment. Those households with college graduates were more likely to have included computer-based entertainment as a component of total household entertainment than those with less than a college education as evidenced by the significantly higher percent assigning ‘some’ contribution. Those with income levels over \$100,000 were more likely than those under \$100,000 to perceive the computer as contributing to home entertainment activities.

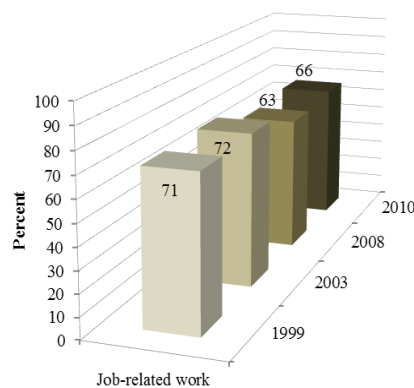
Table 11. Computer contribution to entertainment activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Little to none	41.2 (61)	41.9 (232)	41.3 (197)	50.0 (111)	39.9 (128)	39.2 (248)	40.8 (177)	44.1 (164)	35.7 (76)
Some	33.8 (50)	34.7 (192)	36.5 (174)	23.0 (51)	35.8 (115)	39.4 (249)	32.3 (140)	39.0 (145)	36.6 (78)
A great deal	25.0 (37)	23.5 (130)	22.2 (106)	27.0 (60)	24.3 (78)	21.4 (135)	27.0 (117)	16.9 (63)	27.7 (59)
	X <sup>2</sup> =.794, p=.939			X <sup>2</sup> =19.920, p=.001			X <sup>2</sup> =15.605, p=.004		

### Job-Related Work Activities

Home computers make it possible for employees to connect to the office remotely, essentially allowing work to come into the home. Over the 10 year period, the percent of computer using households reporting this type of use has remained fairly constant, ranging from 63% to 71% [Figure 10].

Figure 10. Household Electronic Job-Related Uses, 1999 - 2010



In 2010, 66% of the households reported some job-related work being done on the home computer. Adult only households and households with children are similar in the percent that use the home computer for work purposes and show a significantly greater proportion of users than single person households (58% single person households, 67% adults only and 68% households with children) [Table 12]. Not surprisingly, households with high levels of education are more likely to report using the home computer

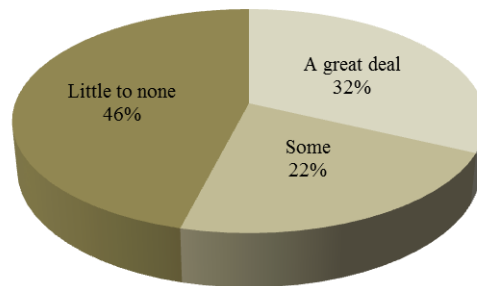
for work-related activities. Seventy-five percent of households with college graduates reported using computers for job-related work, compared to 53% of households with a high school diploma or less. A similar pattern is observed for total household income.

Table 12. Job-related work: household type, education and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Job-related work	57.7 (86)	67.1 (371)	68.1 (326)	52.9 (118)	57.6 (185)	75.2 (478)	59.7 (262)	66.0 (245)	79.7 (169)
	$X^2=5.728, p=.057$			$X^2=50.915, p=.000$		$X^2=25.631, p=.000$			

The contribution of the home computer to job-related work is split between those who find it contributes a great deal and those who do not. Thirty-two percent reported that the computer contributes “a great deal” to job-related work [Figure 11]. Essentially, not all households are using the home computer for this purpose as 46% reported that the computer contributed little to none. This split is likely due to a large proportion of respondents being of working age, and a large proportion being of retirement age.

Figure 11. Computer contribution to job-related activities, 2010



The extent to which the home computer contributes to job-related work at home is not distinguishable by household type [Table 13]. In terms of household education, we find a significant split between those at the low end of the scale, and those at the high end of the scale. Out of the possible responses, those with a high school diploma or less and those with some college were most likely to report the computer contributes “little to none” to job-related work. Conversely, those with college degrees were most likely to report computers contribute “a great deal” to their job related tasks. This distinction is most likely attributable to the types of occupations of those with and without a college education. There are many jobs which do not require any use of computers and/or cannot be performed outside of the workplace. There is a very clear pattern with total household income. As income increases, so does the extent to which the computer contributes to job-related tasks in the home.

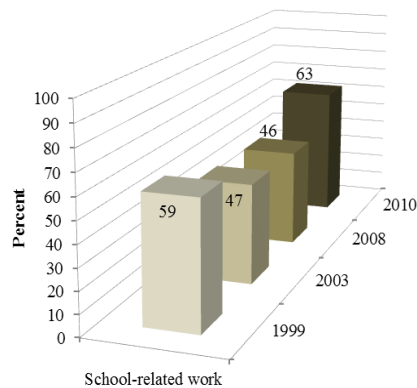
Table 13. Computer contribution to job-related work activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Little to none	47.3 (70)	46.3 (256)	44.0 (210)	59.5 (132)	49.1 (157)	39.1 (247)	49.5 (215)	45.4 (169)	33.0 (70)
Some	18.9 (28)	22.6 (125)	23.3 (111)	21.2 (47)	21.6 (69)	23.3 (147)	24.0 (104)	23.9 (89)	22.2 (47)
A great deal	33.8 (50)	31.1 (172)	32.7 (156)	19.4 (43)	29.4 (94)	37.7 (238)	26.5 (115)	30.6 (114)	44.8 (95)
	$X^2=1.738, p=.784$			$X^2=34.630, p=.000$			$X^2=24.298, p=.000$		

### Education/Learning Activities

In the past two decades, the home computer has been effectively leveraged as an educational tool for children and young adults (Venkatesh, 2006). It is common to find households with children as early adopters of computers and gadgets of all kinds. In 2010, 63% of all households with computers reported using them for education/learning which is similar to the proportion in 1999 [Figure 12].

Figure 12. Household Electronic Education/Learning Uses, 1999 - 2010



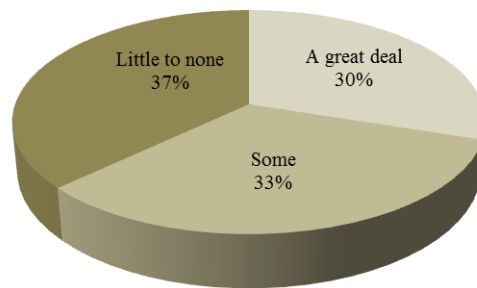
It is no surprise that households with children reported the highest use of computers for education/learning. Fully 80% of households with children reported this use in contrast to 56% of adults only households followed by 34% of single person households [Table 14]. In terms of household education, those with some college education, and college graduates are more likely to use computers for this purpose, as opposed to those with a high school diploma or less. Total household income is also not associated with whether computer-assisted education/learning is done in the home.

Table 14. Education/Learning: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Education/Learning	33.6 (50)	55.7 (308)	79.7 (382)	46.4 (103)	66.4 (213)	66.0 (419)	63.9 (280)	59.6 (221)	68.9 (146)
	X <sup>2</sup> =125.188, p=.000			X <sup>2</sup> =29.849, p=.0000			X <sup>2</sup> =5.129, p=.077		

As we saw with job-related work, the education and training center is an area in which not all households are using the computer, but those that are perceived “a great deal” of benefit from using the computer to complete their tasks [Figure 13]. When considering how much the computer contributes to these kinds of learning-related activities, the most common response was “little to no” contribution. In terms of contribution to education and training, 33% of households reported “some” contribution, 30% reported “a great deal” of contribution, and 37% reported “a little to no” contribution.

Figure 13. Computer contribution to education and learning activities, 2010



Not surprisingly, we find households with children reporting “a great deal” of contribution much more frequently than adult only households or single person households (36% for households with children vs. 28% for adult only households, and 23% for single person households) [Table 15]. Association with educational level in the household indicates that a significantly higher percent of those households with only a high school education or less reported that the computer contributed little to none for education and learning activities. On the other hand, income level does not have a clear pattern, although a significantly higher percent of households with total income less than \$50,000 reported both ‘little to none’ and ‘a great deal’ when considering the extent to which the computer contributed to education and learning activities.

Table 15. Computer contribution education/learning activities: household type, education, and income, 2010

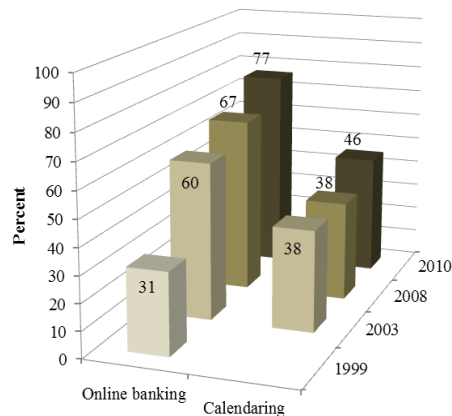
	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Little to none	51.0 (75)	38.8 (215)	29.0 (138)	47.1 (105)	34.3 (110)	33.6 (212)	38.8 (168)	30.9 (115)	34.7 (74)
Some	25.9 (38)	33.6 (186)	35.3 (168)	31.8 (71)	28.3 (91)	36.6 (231)	27.0 (117)	38.4 (143)	37.6 (80)
A great deal	23.1 (34)	27.6 (153)	35.7 (170)	21.1 (47)	37.4 (120)	29.8 (188)	34.2 (148)	30.6 (114)	27.7 (59)
$X^2=28.146, p=.000$				$X^2=24.984, p=.000$			$X^2=14.813, p=.005$		

### Home Management Activities

Types of computer uses found within activities surrounding home management include online banking and financial transactions, as well as calendaring.

Use of home computers for online banking has grown steadily since its introduction, increasing 150% during the period of 1999 to 2010. Online banking typically involves account viewing, bill paying, funds transfers and loan maintenance. Household computer use for online banking has reached a new high in 2010 as 77% of households now use the home computer for this purpose [Figure 14]. The greatest jump (a 96% increase) was between 1999 and 2003 as more banks brought online banking to their customers.

Figure 14. Household Electronic Home Management Uses, 1999 - 2010



Households with children are more likely than other household types to use computers for online banking [Table 16]. While 83% of households with children online bank, we find that number drops nine percentage points to 74% among adult only households, and drops further to 71% among single person only households. Not surprisingly, households with a high level of overall education reported using the computer to online bank more than those households of lower socioeconomic status. Eighty-three percent

of those with college degrees bank online, compared to 64% of households with less than a high school diploma. Similarly those households with total incomes greater than \$100,000 were more likely to perform online banking tasks than those with incomes less than \$100,000.

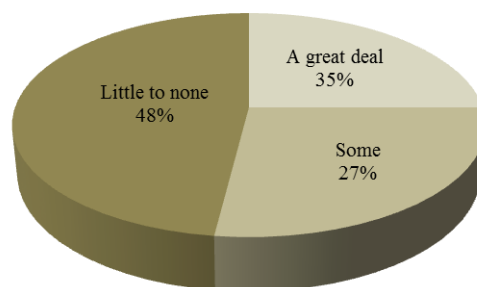
Table 16. Online banking: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Online banking	71.3 (107)	73.5 (407)	82.7 (397)	64.0 (142)	74.1 (238)	83.0 (528)	71.3 (313)	79.8 (297)	86.8 (184)
	$X^2=15.430, p=.000$			$X^2=35.807, p=.000$			$X^2=21.417, p=.000$		
Calendaring	39.3 (59)	45.2 (248)	48.6 (230)	35.9 (79)	41.5 (131)	48.4 (326)	44.6 (194)	42.3 (155)	52.6 (111)
	$X^2=4.135, p=.127$			$X^2=19.575, p=.000$			$X^2=5.905, p=.052$		

Using computers for calendaring can evoke different images to different households. It could mean storing the family’s central calendar, scheduling work meetings in an online calendaring system from home, or setting up a timeline for school homework and projects. Overall, 46% of households reported using computers for calendaring in 2010. While 49% of households with children reported using electronic calendaring, only 39% in single person households reported this type of use [Table 16]. In terms of highest level of household education, those households with college graduates reported the highest level of computer use for calendaring (48%). Conversely, only 36% of those with high school diplomas or less reported using the home computer for calendaring. Those with incomes greater than \$100,000 were also significantly more likely than those with incomes less than \$100,000 to report the use of calendaring.

Respondents were also asked how much the computer contributes to household management in their home, and were given examples like financial management, record-keeping, and calendaring. Nearly half (48%) of households reported that the computer contributed “little to not at all” to household management signifying that most household management tasks are handled off line [Figure 15]. About one third of households on the other hand did believe that the home computer contributed a great deal to household management activities when this center was considered as a whole.

Figure 15. Computer contribution to home management activities, 2010



As with communication, we find no significant differences between different household types in terms of perceived contribution to the home management center [Table 17]. However, there are distinct differences between different household education levels. Households with college degrees were likely to report “a great deal” or “some” computer contribution to the home management center, while households with high school diplomas or less or some college were likely to report that the computer contributes “little to not at all” to this center. The extent to which the computer contributes to home management activities is also higher in those households with incomes greater than \$100,000.

Table 17. Computer contribution home management activities: household type, education, and income, 2010

	Single person	Adults only	Adults and children	High school or less	Some college	College graduate	Under \$50,000	Between \$50,000 and \$100,000	More than \$100,000
Little to none	46.6 (69)	48.9 (270)	47.0 (224)	60.6 (134)	57.5 (184)	38.9 (246)	54.0 (234)	46.5 (173)	33.5 (71)
Some	21.6 (32)	26.4 (146)	28.5 (136)	21.3 (47)	21.6 (69)	30.9 (195)	24.0 (104)	28.2 (105)	29.7 (63)
A great deal	31.8 (47)	24.7 (136)	24.5 (117)	18.1 (40)	20.9 (67)	30.2 (191)	21.9 (95)	25.3 (94)	36.8 (78)
	X <sup>2</sup> =4.897, p=.298			X <sup>2</sup> =46.841, p=.000			X <sup>2</sup> =27.203, p=.000		

## Summary and Discussion

Communication and information-seeking are the hallmark uses of the home computer. Over four-fifths of computer using households reported using the home computer for these activities in 2010. In both instances one-third or more of households reported that the home computer contributed a great deal to these activities in the home. An additional one-third reported that it contributed at least ‘some’ to communication and information needs in the home. An interesting question would be the extent to which these computer-assisted activities have replaced earlier forms of communication, namely, letter-writing and phone calling as well as face-to-face visiting. There are signs that it has replaced these activities as the need for a daily postal service has decreased significantly during the rise of the Internet and home encyclopedia sales have dropped dramatically, for example.

Shopping and vacation planning are also activities that have switched from physical stores and travel agencies to online activity. Roughly four-fifths of the households used their computers for these activities and over one-third of the households reported that the computer has contributed a great deal to these activities. Yet, over two-fifths of households reported that the computer had little to no impact on shopping overall. This is a household activity that still has many tasks that have not been automated. While there are some types of physical objects that are generally obtained through online shopping, e.g., books and music, there are other types of bought objects that are much less likely to be obtained online, e.g., furniture, food and perishable items.

We find that same breakdown when it comes to entertainment. While entertainment, particularly game playing and many hobbies, have consistently been a part of computer uses, it is interesting to note that

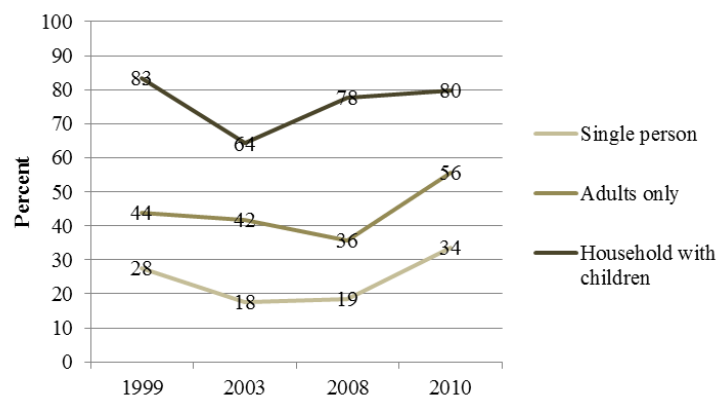
over 40% of respondents reported that the computer provided little to none overall to home entertainment activities.

Both job-related work and learning are specific to certain types of households. More of the learning activities are found in households with children and, of course, job-related work is focused on households where there are members in the job force. As such, the percent of computer use within both of these household activities has remained fairly stable over the 10 year period.

The one area where there have been the most dramatic shifts is in the use of the computer for home management purposes. Online banking, for example, has risen from 31% of the households in 1999 to 77% of the households in 2010. At the same time, nearly half of the households reported that the household computer contributed little to none to these home activities. So far, this area of household activity remains less computer-centered than others.

The overall figures provide some understanding of the use and contribution of the computer within the household. But, clearly, there are variations in the use and contributions when we take into account the type of household. The descriptive analysis above points to significant variations in computer use by household type, although there are also similarities. We noted above how household types make a difference in the emphasis on learning in households with children in contrast to single person households. Indeed the difference is striking. Eighty percent of households with children use the computer for learning/education purposes while only 34% of single person households use the household computer in this way. These differences have been similar across the entire time period. In Figure 16, we've plotted the percent over the four surveys. Similar patterns are shown for each household type, the only differences being the percent of households within each type using the computer for learning purposes.

Figure 16. Use of household computer for learning purposes by household type, 1999 – 2010.



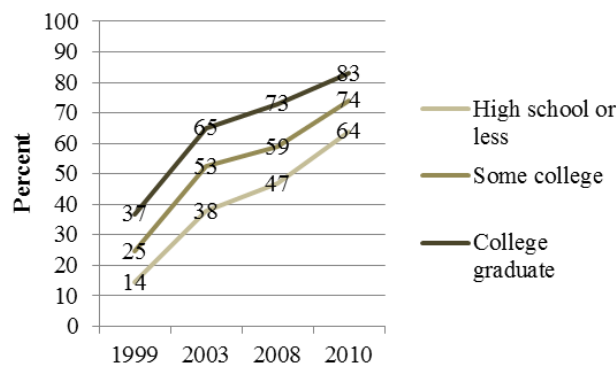
Indeed, if we compare household uses by household type, significantly more households with children use the computer for more activities than single person households. Of the 12 automated activities, over 80% of households with children perform ten of the activities, in contrast to eight of the activities in multi-adult households and only three activities in single person households [Table 18].

Table 18. Comparison of household type and household computer uses

	Single person	Adults only	Adults & children
Email	<b>97</b>	<b>99</b>	<b>98</b>
Entertainment	69	<b>81</b>	<b>93</b>
News, weather, etc.	<b>85</b>	<b>87</b>	<b>92</b>
Photos	73	<b>83</b>	<b>91</b>
Products, services info	<b>89</b>	<b>93</b>	<b>90</b>
Online networking	59	73	<b>87</b>
Shopping	79	<b>86</b>	<b>86</b>
Banking	71	74	<b>83</b>
Health info	71	<b>87</b>	<b>81</b>
Learning	34	56	<b>80</b>
Travel	69	<b>82</b>	76
Job-related	58	67	68
Calendaring	39	45	49

The level of education in the household continues to have an impact on the degree to which some household activities have been automated. This is particularly apparent in the household management center where significantly more college-educated households use the computer for calendaring of activities and online banking. It has less of an effect in terms of communication and information uses. Online shopping and online travel planning also are significantly more likely to be done in households in which there is at least one college-educated member. Similar to household type, if we look at the distribution of uses over time we note that the relationships between household education and household uses remain fairly similar from one time period to another. Figure 17 shows the relationship over time for online banking.

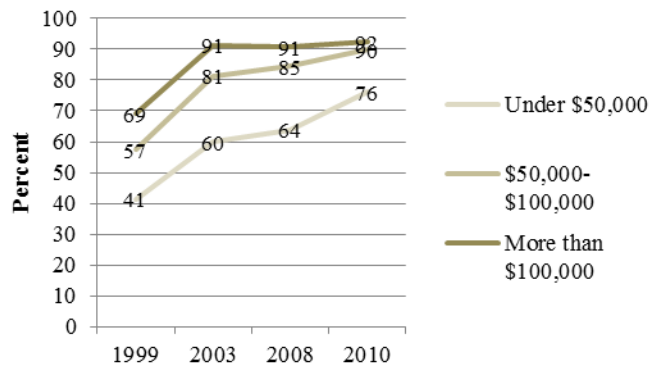
Figure 17. Use of household computer for online banking by household education level, 1999 – 2010.



Income also continues to have an effect on the types of uses that are done with household computers. For almost all the computer uses considered in this paper, level of income was a factor. Only three uses were not associated – online networking, hobbies and entertainment and education/learning uses. Two of these uses (education and entertainment) are long-time uses of household computers, observed even in the early years of home computing and the other use is fairly recent (online networking) but a very rapidly growing

use which has quickly spread not only over different income levels, but to some extent varying age groups and household types. But, it is still interesting to note that even among computer using households, income distinctions are visible. What is also seen when looking at the uses over time is that at least for some uses, there has been a narrowing of the gap among the income levels. For example, online shopping has increased over time for all income levels, but in addition, there is no longer a gap between those households with total income \$50,000-\$100,000 and those households with total income over \$100,000 and the gap between these income levels and that of under \$50,000 has narrowed significantly [Figure 18].

Figure 18. Use of household computer for online shopping by household income level, 1999-2010



In summary, this report has presented not only a view of computer use over a ten year period, but also the extent of computer activity and contribution within each area of the household. In many areas of the household, there is significant computer use. While there may be significant use of the computer, the extent to which computer use has diffused within a household center and made strong inroads into contributing to all the activities in a household center are not fully realized. There are many additional facets of home activities that could possibly benefit from automation. At the same time, it is probably the case that for some home activities, efficiency and effectiveness through computer applications will only go so far. There is clearly much additional work necessary to fully map computer use and contribution within household activity centers. It is also important to begin to more fully understand the interaction of household type, education and income in achieving positive effects from the use of personal computers in the home. This paper provides an opening dialogue to these areas.

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