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Online education as a toll good: An examination of the South Carolina virtual school program

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ABSTRACT

Education has long been considered merit good; however, inequitable distribution has made it more akin to a toll good. This was most recently demonstrated by Henry, Fortner, and Thompson (2010). Choice requirements designed to remedy the inequitable distribution of education, have largely been confined to brick and mortar schools. Subsequently, they face challenges comparable to traditional programs. With shrinking state budgets and an increasing achievement gap, online choice options are growing in popularity as means of satisfying choice requirements specified in No Child Left Behind. This paper considers whether online options facilitate education as a merit good, or if they extend education as a toll good.

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1. Introduction

Every state in the US provides education as a matter of normative principle. An extension of this fact is that K12 education is considered a merit good – a good provided free for society because it would be under provided if left to the market (Musgrave, 1957). In terms of policy as well as academic discussion this categorization has been accepted as legal precedent as well as a separate ontological category of good – see *Abbeville v. State of South Carolina (1999)* and Ver Eeke (2003). While education itself is a merit good, the provision of education in the US is treated more akin to a toll good – it is excludable but is not rivaled in consumption. The impact of this was recently noted by Henry, Fortner and Thompson (2010) in their study of education supplements in North Carolina. Additionally, this is evidenced by the geographically disparate standards and performance over extended periods of time, as well as relative deprivation in terms of infrastructure and budgets which have made the provision of education something much more akin to a toll good, not simply interstate, but intrastate as well. This means that instead of being provided as a societal good, market forces have come into play in education making the provision and outcomes of education excludable, although not rivaled in consumption.

To remedy the results of these relative deprivations, choice options have been put in place. This is not simply a matter of altruistic practice, but rather is a matter of legislation under the No Child Left Behind Act – which is designed to give options to students enrolled in failing schools. Despite the policy of school choice options, the de facto provision of school choice is tied to the same limitations as the provision of traditional public education – budgets are shrinking, infrastructure issues persist and transportation issues continue to arise. These issues have tended to hit "At-Risk" students the hardest (Khattri, Riley, & Kane, 1997). This is particularly true in poor and rural areas (Seal and Harmon, 1995; Tracey, Sunderman, & Orfiled, 2005). At-Risk students are disproportionately males from minority populations and are generally from low socioeconomic backgrounds (Donnelly, 1987; Kominski et al., 2001; Logan & Yaacov, 2010). The National Center for Education Statistics (1997) defined an At-Risk student as one who is likely to fail at school – dropping out of school before high school graduation. As a means to ensure adherence to policy, while considering budgetary limitations, many schools are turning to online education to satisfy their choice requirements. However, with disparities in technology access and technology training between At-Risk students and those not considered At-Risk, a question of equity is raised; is online education to satisfy choice provisions actually creating choice, or simply another toll good?

Online education has been an option for post-secondary education for several years now, but has only recently begun to be offered as an option for K12 education. As a result, precious little research is available on online K12 education. So while these programs have been

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evaluated and seriously considered at a post-secondary level, the use of online technology in K12 education has yet to receive this same kind of serious academic consideration (Berge, 1997; Harasim, 2000; Volery & Lord, 2000). A meta-analysis of the five studies which have been conducted found that online programs are just as effective, if not more so, than traditional classrooms (USDE, 2008). I question the accuracy of statements like this on the grounds of population selection. Online learners are a self selecting population, so the ability to generalize about the effectiveness of online learning should be confined to this self selecting population. When considering the effectiveness of online secondary education, several questions arise concerning not just effectiveness but also the equitable distribution of access and the equitable distribution of abilities. This paper considers the two latter points. Particularly it looks at the access and ability in At-Risk Communities in the South Carolina Virtual School Program.

Traditionally, online learners are considered to be self motivated learners with good reading and writing abilities and adequate technology skills (Barbour, 2007). As Barbour (2007) noted, this is not the case. There is a danger in making either assertion on the grounds of both measurement and heuristics. This danger is found in the definition of an online learner. Is an online learner one who simply takes a course online or one who successfully completes a course online? As a point of heuristics it could obviously be both, but as a matter of practicality we want to consider the latter. So while iNACOL (2009) points out that 46% of their programs consist of a majority (51%+) At-Risk students, this does not speak to the effectiveness of the programs at educating this population, only the fact that they are being served.

In addition to questions of access to, and use of, online education, a variety of research questions arise which are important for online K12 education moving forward. Specifically, what are the implications of replacing or supplementing brick and mortar schools with online programs? The implications range from the impacts of the teacher as role model in model a brick and mortar school; the impacts on learning outcomes of replacing specific tangible objects with a virtual proxy, i.e. a dissection in a biology class versus a virtual dissection in an online program; finally, the impacts of peer effects in a virtual environment versus a traditional classroom. While these questions are addressed to some degree within this paper, they are areas which need further research.

2. Types of goods

The concept of goods is a necessity for economics and is a key component for political science and public policy literature, but has yet to be widely discussed in the education literature. Goods are traditionally described in four categories based upon who has access to their use and whether their use is excludable and whether the good is rivaled in consumption. These categories are public, private, common pool, and toll goods. Merit goods, while not generally considered in the discussion of markets, occupies a special place for reasons which will be discussed shortly.

Before defining the types of goods, it is necessary to define what is meant by *excludable* and *rivaled in consumption*. For a good to be excludable simply means that a person may be excluded from using it. A good may be excluded based upon price, in that a person cannot use the good without paying for it, or by extension paying a specific price for it. Any product which must be paid for is by definition excludable. However, the level to which a good is excluded is based upon cost; this addresses the quality of the good. For example a yacht is much more excludable than a row boat.

For a good to be rivaled means that one person's use of a good diminishes another person's use, or potential use. Food would be an example of a rivaled good. If one person eats a portion of food, then the entire amount of food available to another person is diminished. An example of a product which is not rivaled would be television. One person's watching television does not diminish the amount of television that another person can watch. For the purposes here, the author will not go into detail concerning all qualities of types of goods. In depth discussions concerning types of goods can be found in a variety of works by Musgrave (1957, 1959), Olson (1995), Ostrom (1999, 2000), Ostrom, Poteete, and Janssen (2010), and others.

2.1. Public good

Public goods are defined as those which are not excludable and not rivaled in consumption. Anyone can use them and that use does not diminish the ability of another person to use that good. Economic models are poorly equipped to deal with public goods since the goods themselves do not have a market. For this reason, the private sector will rarely provide public goods unless compelled to do so (Tiebout, 1956).

2.2. Private good

Private goods are the exact opposite of Public goods, they are both rivaled in consumption and are excludable. Take for example the purchase of a car. A person is excluded from buying a car because a car has a price. Furthermore, people are prevented from buying specific cars based upon specific prices, i.e. a person may be more able to purchase a domestic sedan than a foreign luxury car. Additionally, when a person purchases a car they diminish the number of cars available for purchase by any other individual at that time.

2.3. Common pool good

Common pool goods are those which are not excludable but are rivaled in consumption. Examples of common pool goods would be fish in the oceans or non-toll roads (congestion). A person cannot be excluded from using these goods based upon a market for the goods, but the use of the goods diminishes the ability of another person to use that good. A classic example of this is the tragedy of the commons scenario. In this scenario, individuals who act rationally in pursuit of their own self interest use a common pool good. It is rational for them to use as much of the good as they possibly can because they maximize their utility by doing so. Unfortunately because each individual is acting rationally, they diminish the utility of the collective. Consider grazing cattle as an example. If a group of farmers all graze their cattle on the same land, and each farmer is acting as an individual with their own self interest in mind, then it behooves them to graze their cattle as much as possible. If each person thinks this way then the field collapses and no one is able to graze cattle. Not all common pool goods result

in a tragedy of the commons scenario since individuals may put aside their individual self interest in favor of collective interest, but the example is useful for the definition of common pool goods.

2.4. Toll good

A toll good is the opposite of a common pool good in that toll goods are excludable but are not rivaled in consumption. The term "toll" is applied because the good is either paid for, or conditions may be established where it is effectively excluded based upon ancillary conditions for use which may be based on previous ability to pay. A classic example of a toll good would be a private park or a park for which an entrance fee is charged. The use of the park is controlled by the admission fee, but the outputs (the ability to enjoy the park, the ability to take pictures of animals, etc.) are not rivaled.

2.5. Market failures

Strictly defined, market failure is a condition where the allocation of goods in a free market is inefficient (Ledyard, 2008). Markets fail for three primary reasons, excess market power by one agent, externalities and imperfect information concerning the costs and benefits of the transaction. Excess market power would be a case in which monopolistic competition exists or cartels are artificially controlling the prices of goods. Externalities are defined as costs or benefits not transferred in prices and incurred by a group or individual who was not party to the actual transaction. Imperfect information is a situation where at least one person involved in the transaction has information which is relevant to the transaction that the other party does not.

2.6. Merit goods

Market failure was addressed prior to addressing merit goods because merit goods exist despite conditions of market failure, specifically positive externalities – *although positive externalities may be a good thing, they are still a condition of market failure and because of this transactions resulting in positive externalities are often underprovided by the free-market because the benefits beyond the transaction cannot be monetized* (Musgrave, 1957). This then is the definition of a merit good, it is a good which is considered to be socially desirable, independent of the actual desires of the consumer itself. Because of these considerations, the private sector will not provide merit goods because consumers will be unwilling or unable to purchase the good, despite the benefit they receive from it. Education is a classic example of a merit good. An educated population is desired by society, but individuals are typically unwilling or unable to directly provide education as a matter of individual ability. For this reason, education is provided for the public welfare by state and local governments (Kaisheng, 2003). Education creates a positive externality because more educated individuals are less likely to be involved with violent crime. This makes everyone in the community, even those who are less educated, better off; even though the transaction occurred during the learning process, the benefits extend beyond the transaction.

3. Addressing At-Risk students

The National Center for Education Statistics (1997) defined an At-Risk student as one who is likely to fail at school – dropping out of school before high school graduation. The previously mentioned US Department of Education report (USDE, 2008) examined seven sets of variables associated with At-Risk students: basic demographic characteristics; family and personal background characteristics; amount of parental involvement in the student's education; student's academic history; student behavioral factors; teacher perceptions of the student; and characteristics of the student's school.

At-Risk students are disproportionately males from minority populations and are generally from low socioeconomic backgrounds (Donnelly, 1987; Kominski et al, 2001; Logan and Yaacov, 2010). Educators have a long tradition of inadequately addressing the needs of At-Risk students. As Oakes (1985) and Wheelock (1992) note, the courses provided to address the needs of At-Risk students are often substandard and reinforce low expectations. Educators have traditionally responded to the identifiers for At-Risk in an effort to address the outcomes of being "At-Risk." This includes separating students into ability groups, pulling students out of their normal classes for remedial work and grade retention (Legters, McDill, & McPartland, 1993). After the advent of the much maligned No Child Left Behind Act many of these practices ceased, but provided a host of new issues for At-Risk students – see NCLBA (2001) 1001-20 U.S.C. 6301. The legislation focuses on getting help earlier for students identified as "At-Risk." Subsequently, more of these students are performing well on standardized tests on the aggregate, while states with traditionally poor academic performance are left altering standards or continuing their tradition of underperformance (Tracey et al., 2005). Most onerous though is the fact that the act has "perverse incentives" which discourages advancement among At-Risk students in an effort to meet arbitrary standards (Ryan, 2004).

These incentives result from the focus on absolute achievement as opposed to rates of achievement and have caused the best teachers not to be recruited by the schools in greatest need and encouraged segregation by pushing out poor and minority students (Ryan, 2004). In an effort to address the needs of At-Risk students the NCLB includes a provision for school choice. Many districts and states are meeting this provision through the use of Virtual Schools as opposed to brick and mortar schools (Hassell & Terrell, 2004). Studies of the effectiveness of Virtual Schools and online learning have been proven in Adult Education programs, however children learn differently than adults (Freeman, 1999; Harris & Koenig, 2006).Also, the identifiers for At-Risk would seem to preclude success in an online class. There is no reason to assume a student who is identified as struggling in a traditional class would do any better in a virtual class where the knowledge threshold is higher. This simply means that a student in a virtual class not only needs to grasp the subject matter but also must be able to operate within the virtual environment.

4. Technology and At-Risk students

Studies on the value of technology for addressing At-Risk students are fairly conclusive in terms of results. However, they are divided on how the digital divide should be addressed – most specifically, whether or not it is being addressed with an eye towards effectiveness and equity rather than simply nominal allotment of technology. Edmonds and Li (2005) found positive results using technology integrated with and in place of individualized instruction and open communication. Their findings were not conclusive however, as they warn against using technology exclusively as it may create an entirely new set of problems – referring to the digital divide. A number of studies have found positive impacts from technology use on At-Risk student in early childhood (Kemker, Barron, & Harms, 2007; Parrette, Hourcade, Boeckmann & Blum, 2008). However, the preponderance of studies concerning technology use in secondary education for At-Risk students finds better results from after school or community programs than from direct use of technology.

Kuttan and Peters (2006) found that while technology can have positive impacts, the direct use of technology in classrooms is ineffective due to inequities in technical abilities among high poverty and minority students. To remedy this they offer three primary suggestions at the organizational level, chief among these is, "creating statewide integration approaches that would make technology an important ally for the academic standards movement," (Kuttan & Peters, 2006). Additionally, studies by Page (2002) found significant differences in achievement between At-Risk students who used technology in the class and those who did not. Despite these positive findings, the aforementioned studies were small in scale, with Kuttan and Peters' work based on case studies looking at economic enhancement and Page's work looking at 10 classrooms with two study groups. Broader scale studies have shown less positive results.

A study conducted by Eamon (2004) from national survey data found that the frequency of computer use by poor and non-poor students was not significantly different; although there was a significant difference between the rates of non-academic use. This was due primarily to the fact that poor students lacked home access and relied mainly on school computers (Eamon, 2004). Additionally, the work of Muir-Herzig (2004) suggests that while technology may be an effective tool for addressing At-Risk students, its use in the classroom has been questionable and the manner in which it has been used is not the most efficient means of increasing student efficacy.

5. Social impacts for online learning

Aside from the considerations of equity, some serious social questions are raised concerning the use of online education. Specifically, questions concerning not just the effectiveness of virtual schools as compared to traditional schools, but also the desirability of their usage for reasons of socialization, regardless of their effectiveness. While there is limited research in this respect, the research regarding online interactions between teachers and students for content purposes shows that student–teacher interactions in the online environment are similar to those in the traditional classroom. Furthermore, with regards to content, it appears that asynchronous communication provides a more effective medium for eliciting reasoned responses which are relevant to content, whereas synchronous communication, while direct, has a less specific content focus.

This question has been addressed by Tomai et al. (2010), with regards to social capital in virtual schools and has provided interesting results. Putnam (2000) defines social capital as, "the collective value of all social networks and the inclinations that arise from these networks to do things for each other." The findings of Toma et al. (2010) indicate that online learning increased both bridging (heterogeneous networks) and bonding (homogeneous networks) social capital. This is a divergence from broader research in the development of social capital online in the broader sense (community-wide). Subrahmanyam, Greenfield, Kraut, and Gross (2001) found increased levels of depression and decreased levels of social interaction among adolescents (10–12 years of age) were associated with heavy Internet usage.

With regards to social interactions in the online community, the role of the teacher becomes an issue. In the traditional classroom, the teacher serves the function of educator as well as role model (Lunenberg, Korthagen, & Swennen, 2007). Ahern and El Hindi (2000), found that the asynchronous nature of online communication provided a classroom dynamic similar to that found in a traditional classroom. However, Converse et al. (1998) asserted that while the fluidity of the interactions and the ability of students and teachers to "stay on topic" were greatly diminished in the online setting. This was attributed to the use of conversational language in discussion forums. Given the age of the Converse et al. study, it is possible that advances in technology and an increasingly wired culture may show different results today. Davidson-Shivers et al. (2000) compared synchronous and asynchronous communication mediums to determine the impact on content-related participation. Their findings indicated that synchronous communication (chats) provided more direct responses whereas asynchronous (message board and listserv) responses were more focused and content specific. They attributed this to the fact that students and teachers had more time to reason and consider their responses.

In addition to technical abilities is the question of volition, or self motivation. Unlike the traditional classroom, the online learning environment does not provide a means for a teacher to compel a student to participate or to do their work. The question of volitional competence then takes on great importance. As noted by Deimann and Bastiaens (2010), "A [Distance Education] learner is challenged by multiple and conflicting responsibilities (e.g., family, job), which may endanger his/her motivation to learn." In previous studies of online learning it has been demonstrated that a student's perception of a student "checking in on them," can increase a student's motivation over a longer period of time due to, "the explicitness and enduring quality of online textual communication" (Hughes, McLeod, Brown, Maeda, & Choi, 2007). This research is interesting, in that it may be a means of addressing the issues of delayed gratification in online education which have been noted by Deimann and Bastiaens (2010).

The author would make this case given the findings concerning the impacts of factors of *Consequence Control* (what happens if a student does not complete an assignment) and *Volitional Self Efficacy* (a student's perceived ability to successfully complete course work). It is conceivable that if an online teacher is maintaining contact with a student, these issues will be readily addressed and a student's motivation will increase. When considering At-Risk students, one must also consider the corollaries of poverty and their impacts on student achievement. Among these are emotional trauma, poor nutrition, etc. The latter may be addressed through school lunch programs, but the former has a major impact on a student's volitional competence (Brophy, 2000). While this paper does not deal explicitly with volitional competence in online learning, this would be an area for future research.

6. Previous studies of online programs

Few studies have addressed the impacts of risk factors on success in online education. Hughes et al. (2009), in their study of success in online Algebra courses versus traditional Algebra courses considered factors of race and parents' education, as well as whether or not the student was enrolled in a college preparatory program. Their findings indicate that online learning may be a viable option for students regardless of their desire to attend college and that race did not play a factor. However, their results also indicated that students within the virtual school were more likely to perform better than students in traditional schools and that older students performed worse than younger students. Since wealthier schools can offer Algebra I courses in eighth grade, the latter result may be an impact of poverty on performance, i.e. older students who were taking Algebra I regardless of whether it was online or traditional could have been from higher poverty schools, this was not addressed in their analysis. Additionally, the authors did not address the impacts of self selection on the study.

The potential impact of these factors was previously addressed by Clark (2001) in his survey of Virtual Schools throughout the US. Among the major impacts noted in his study were demographic factors and a need to increase the equitable access to online learning. Recommendations from his study included targeting technology innovations directly to high need students. This recommendation brings up a potential causal factor which needs to be examined and one which is acknowledged in this paper. While online learning may provide an effective alternative to the traditional classroom, prior experience with technology cannot be discounted in addressing equitable access. To put it another way, a student with high anxiety or limited experience with computers can in no way be expected to perform as well as student with broad computer knowledge. This may seem self evident, but the results of previous studies would seem to indicate that this is not being addressed from a policy perspective.

Dodd, Kirby, Seifert, and Sharpe (2009) found that secondary students who successfully completed a course were more likely to go on to complete their first year of post-secondary education. While these results reinforce the position of online education as a viable option for students and demonstrates the capacity of online education provide positive educational experiences, it does not go to the question of self-selection in online education.

Previous studies have examined the impacts of persistent computer usage on educational outcomes among minorities and English Language Learners (ELL). Chang and Kim (2009) found that mere access to computers did not necessarily correlate with improved academic achievement. Their study of minority and ELL students found that while persistent computer usage was associated with improved performance in science courses, limited use, or simple access without persistent use was associated with negative performance in science courses. Furthermore they found a more pervasive use of computers amongst White Non-Hispanic English speakers than among minorities and ELL.

7. Online education as a toll good

If online education is to be thought of as a toll good it must first be established that it is in fact excludable. This is easy enough to do anecdotally, after all, it is well established that computer ownership, let alone Internet usage is lower amongst poor and rural communities than among more affluent communities (Cisco Systems, 2009). However, the lack of access is not a sole determinate factor in excludability; after all, many schools offer technology labs, have computers in the library or provide laptops by request. To this point the question is one not just of school budgets but also of motivations and the laboriousness of the process. The first point needs to be defined by poverty rather than geography. According to a 2002 survey by the National Center for Educational Statistics, rural schools are more likely to have access to technology than urban schools (NCES, 2002). Parsing this out geographically ignores the realities of the urban poor. If this is sorted by poverty rather than geography then we get a better picture of the relative deprivation in school technology budgets. Atwell (2001) found that while the use of technology as a whole is growing among schools, poor schools continue to lag behind wealthy schools in terms of technology access and access to bandwidth. So the point of relative deprivation being established, it is necessary to define some point of motivation as well as desired outcomes. Whether intrinsically or extrinsically motivated the benefit that a student sees in struggling to overcome issues concerning access to technology is temporal. While the long term benefit of education has been well established, the short term benefit that a student sees may influence their decision much more. Since these costs are lower in wealthier schools and communities the cost:benefit ratio is much lower.

8. Case selection

South Carolina was selected as case for two primary reasons 1) the State has a high poverty and has traditionally performed poorly when compared to other states nationally. Traditionally poverty would be considered endogenous to lack of access to technology. However, since 1996 South Carolina has had Internet access on a T1 capacity or greater in all of its high schools. So in a de facto sense, every student in the State has access to technology. 2) The South Carolina Virtual School Program was rated as the number two program in the country by the Center for Digital Education. This is as compared to 45 others stated with online learning program. If online learning can be said to have an equitable impact then it would seem most likely to be the case in a state which has all of its high schools networked and a highly rated program providing service.

South Carolina's education system has traditionally lagged well behind the national average in almost all academic categories (Edgar, 1999; USDE, 2003, 2010). For the 2009–2010 academic year, South Carolina was ranked 45th out of 50 states (USDE, 2010). School districts within the State tend to be spatially distributed along lines which indicate a high degree endogeneity between race and poverty – with a larger proportion of white, non-Hispanic students living in high poverty areas – see Fig. 1.

The dropout rate for white male students in 2007–2008 was 3.9%; the dropout rate for non-white male students was 5.2%. The rate for females was significantly lower than both regardless of race (SC Department of Education, 2010). While there is no reason to believe that a student of a different ethnicity would naturally perform better, given the high degree of endogeneity, race will be considered as a dummy variable of white non-Hispanic and other (0,1). Discounting ethnicity, there is a positive correlation between poverty index scores and dropout rates, i.e., as the poverty index increased so did the dropout rate (SC Department of Education, 2010). These students tended to be

	Rivaled	Not Rivaled	
Excludable	*Private Goods:* food, clothing, boats	*Common Pool:* Fishing stocks, lumber, oil	*Merit Good:* (May or may not have qualities rivalry or excludability) Ex: Vaccination, Education, etc.
Not Excludable	*Toll Goods:* private parks, cable television, movies	*Public Goods:* National Defense, Television	

Fig. 1. Types of goods.

from districts with high minority populations and high poverty indices (SCDE, 2010). These same factors were identified by Roderick and Camburn (1999) in their study on recovery from course failure.

Given the low performance in South Carolina schools, especially those schools which are in high poverty areas, any intervention which involves access to technology would most likely not be highly beneficial to those students living in poverty. This is because access to technology, or the lack thereof, can be seen as partially endogenous to poverty index (Judge, Pucket, & Bell, 2006; Valdez & Duran, 2007). While this would tautologically seem to be the case, South Carolina is unique in that the State was the first to completely network all its schools (SC K12 Tech Initiative, 2009). So in a de facto sense at least, all students have access to technology.

9. Program description

The South Carolina Virtual School Program (SCVSP) was put into regulation in May 2007 and began offering courses in 2007–2008. The objectives of the SCVSP are to augment the traditional high school curriculum by offering standards based online classes; to allow access to advanced and specialized courses which may not be offered in the traditional "brick and mortar" school; and to provide credit recovery programs for students throughout the State. This includes supplementing the curriculum in some areas of the State where particular classes may not be offered as well as providing non-traditional learners with another option to earn their high school diploma. Included in this designation of "non-traditional" are those who may need flexible schedules to complete their high school education, i.e. students with children, students with mitigating work schedules/circumstances, etc.

Students may enroll in the SCVSP for any class they wish, provided their Guidance Counselor approves the course credit for their transcript, and their parents give the student permission to take the course through the SCVSP. In addition to parent and Guidance Counselor approval, each student must take a technology assessment before they begin the course in order to assess their ability to operate in an online environment. This technology assessment measures the student's proficiency at operating in an online environment. These proficiency measures include demonstrated abilities to navigate a web page, open and post in forums, as well as a student's understanding of online etiquette and academic integrity in an online environment. A student is required to score at least 80% on this assessment in order to register for a course with the SCVSP.

The fact that a parent must give permission and the fact that the population is self selecting will be discussed later. However, it does presume some degree of extrinsic or intrinsic motivation as well as some degree of home support. It is possible for this to be rated on a spectrum, however because the data are post-hoc this could not be done for this study. Schools must agree to make technical support available to a student if necessary. Kozma and Croninger (1992) point out that technology can improve the learning outcomes of At-Risk students, but that it requires technology interventions to build upon their abilities. As they state, "a learner's current understanding plays an important role in new learning… how the knowledge is structured, organized and represented in memory has bearing on the outcome of a learning episode," (Kozma & Croninger, 1992).

Teachers also have specific communication requirements within the SCVSP. Teachers are required to check in with students at the least, once every two weeks, in addition to giving feedback on tests, quizzes and homework. This "checking in" is done through email. Teachers will email students their grades and progress reports. In addition to "checking in" teachers also engage in direct communication with students. Direct teacher–student interactions occur through a variety of mediums including chat based communication such as instant messengers, as well as class based discussion boards. In this way the SCVSP effectively addresses the two factors identified by Deimann and Bastiaens (2010) as a means of increasing student motivation.

The technical infrastructure of the SCVSP allows students to work at their own pace. The courses are available 24 h a day, allowing a student to access and work on assignments or projects and to submit work to be graded at any hour of the day. This does not mean that deadlines are not enforced, rather that students are allowed complete coursework on their own time. According to a report by the USDE, this ability to work at one's own pace is a key determinate of success of online learning programs as compared to traditional classrooms (USDE, 2008). Communication in the SCVSP is both synchronous and asynchronous. Students may contact their instructors through a variety of chat mediums in addition to the use of message boards in each class. Students may work ahead and complete all assignments early if they wish. However, they are required to maintain a defined rate of progress to remain in the course. Students are expected to finish all coursework in a maximum of 20 weeks (eight weeks in the Summer) or longer if extenuating circumstances provide that a waiver may be granted (Home Bound, Hospitalized, etc.). Additionally, parents are provided with 24 h access to their student's grades and progress throughout the course.

10. Purpose and method

The purpose of this paper is to examine the effectiveness of, and equitable access to, the SC Virtual School Program in schools of varying poverty levels as well with high correlates for "At-Risk." This is important for two reasons, one normative the other as a contribution to the literature. Normatively this is important because this study can be used to identify and refine methods of online course delivery to meet the needs of At-Risk students. Academically, because there have been few studies dealing with online options for secondary education, this study opens the way for expanded study in this growing field. As previously mentioned, effectiveness can be looked at in terms of the motivation.

11. Data collection

Data were collected from the SC Virtual School Program's VSA learning module as well as the SC Department of Education for academic years from 2006/2007–2009/2010. The data from the SCVSP consisted of student performance data: completion status (Pass), ethnicity (Eth), school poverty index (SPI), course level (Level) and number of days spent in the class (n Days) until completion, failing or withdrawal. Data on SPI was collected from the SC Department of Education and matched to schools within the SCVSP.

A drawback of this data is that the unique student number used to identify a student's progress was self reported so a longitudinal analysis could not be attempted. Overall this resulted in $n = 24{,}107$. Courses for which a grade could not be received such as Exit Exam preparation courses were removed. An additional consideration which shall be discussed later is the issue of withdrawals. Students may withdraw within the first 10 days of a course. This will not be reflected upon their transcript and no grade will be received. A student may also withdraw after the first 10 days of the course, in which case they will receive a failing grade for the course. As shall be discussed in the section entitled School Poverty Index, Home School and Private School students were not included in this analysis since they do not report a poverty index to the SC Department of Education. Coding these students at a School Poverty Index has the potential to confound the data, instead they were simply removed.

11.1. Pass

The dependent variable Pass was coded as a binomial variable (0 = Not Pass; 1 = Pass). Pass means that a student completed the course of study with a grade of 70 or above. Not Pass has two possibilities, which requires two analyses to be run. There are two ways in which a can Not Pass, they may complete the course of study with a failing grade, or they may withdraw from the course with a failing grade. As per the South Carolina Uniform Grading Policy this means that a student withdraws from the class after 10 days. The analysis will consider both possibilities.

11.2. School Poverty Index (SPI)

School Poverty Index (SPI) was used as an indicator of At-Risk, rather than just National School Program Data. SPI is a percentage of students in a school who are eligible for Free/Reduced Lunch and/or Medicaid. Because Private Schools and Home Schools are not required to report this data, their SPI was entered as 0%.

The primary factor serving as a determinate of success in academic programs in the State appears to be poverty. This is not a recent phenomenon but has historically been the case. This was noted as far back as 1897, "The promises to the people to give them good schools should be redeemed, and to do so the State should at this session make provision for State aid sufficient to bring up all of the country schools to a standard sufficient to meet the requirements of the people," (Mayfield, 2000).

11.3. SPI and ethnicity

South Carolina is 33.5% minority, with 11.5% of families living below the poverty level and 15.2% of individuals living below the poverty level. Of the population 25 and over, 17.9% have less than a high school diploma (US Census Data, 2000). This is below the US average on every measure. Eth was coded as a dummy variable, (1 = minority, 0 = White Non-Hispanic). While they are predominately White Non-Hispanic ($p = .54$, $n = 7{,}009$), followed by African–American ($p = .38$, $n = 4{,}392$), when split dichotomously between White Non-Hispanic and minority, the minority sample approaches something closer to even ($p = .46$, $n = 5{,}971$).

11.4. Level

Course Level was coded as an ordinal variable (Content Recovery = 1, College Preparatory = 2, Honors = 3, AP = 4), (Level = 1–4). Content Recovery courses are remedial courses taken by a student to earn credit for a class which they have previously failed. The College Preparatory courses are equivalent to the traditional course of study in a brick and mortar school. The Honors courses are confined to third year language courses, i.e. Latin 3, Spanish 3, etc. AP courses are Advanced Placement courses with final exams administered by the College Board for college credit.

11.5. n Days

The number of days the student was in the course was coded as a continuous variable from 0–n. Typically, students with n Days between 0–10 are students who withdrew within the first 10 days of the course, withdrawing without penalty

Table 1
Paired sample *t*-test (stay, not stay).

Welch two sample *t*-test				
t	df	*p*	95% Conf. Int.	
			Lower	Upper
16.001	24,106	0.000	3.747	4.794

$\mu SP_n = 56.73$; $\mu SP_y = 52.46$

12. Results

CRAN-R was used to run the analyses for this study (CRAN-R, 2008). This analysis considered two questions: First, the difference in poverty indices of students who began a class but withdrew within the first 10 days (SP_n) versus those students who completed a class (SP_y). A paired sample *t*-test was used to this end (Table 1).

The mean poverty index for students who completed a course, regardless of passage or failure, was 11% lower than the State mean poverty index. A paired samples *t*-test reveals that the difference between these two groups was highly significant. As indicated, SPI between those students who stayed in the class and those students who withdrew is significantly different at the $p = .001$ level.

12.1. Logistic multivariate regression analysis

Logistic multivariate regression analysis was used to address the odds probability of SPI and descriptive factors traditionally associated with performance, as to whether a student who completed a course passed or failed. A least squares regression could not be attempted due to the high level of heteroscedasticity. SPI was entered as an independent variable. A further analysis was conducted in which SPI was set as an independent variable. Entering SPI as the intercept would have resulted in a different model for every SPI. This analysis did not include students who withdrew during the first 10 days since they never receive a grade for the course. However, students who withdrew after the first 10 days were included, since they do receive a failing grade for the course. Once the students who withdrew without penalty are removed, $n = 12,980$.

$$\log\left[\frac{P(Pass = 1)}{P(Pass = 0)}\right] = \beta_1 SPI + \beta_2 Level + \beta_3 n\,Days + \beta_4 Eth + \varepsilon$$

$$P(Pass = 1) = 1/\{1 + \exp[(\beta_1 SPI) + \beta_2 Level + \beta_3 n\,Days + \beta_4 Eth + \varepsilon]\}$$

Equation 1. Logistic regression.

A four predictor logistic multivariate regression model was fitted to examine the research question regarding the relationship between the likelihood that an At-Risk student successfully completes a class with the SCVSP. The logistic regression procedure was conducted using the CRAN-R Project (CRAN-R, 2009). The results indicated that:Predicted Logit of Pass = $1.170 + (-0.013) \times$ SPI + $(-0.012) \times$ Level + $(0.013) \times n$ Days + $(-0.275) \times$ Eth + ε see Table 2.

According to the model the log odds of a student passing a course in the SCVSP was negatively related to SPI ($p < .01$) and Eth ($p < .01$) but positively related to *n* Days ($p < .01$). This is an indication that as SPI decreases, likelihood of successful completion increases. Level did not show a significant relationship ($p = .635$). This means that the lower the poverty level the more likely a student will be to successfully complete a course. However, this is not a strong relationship, as it does not approach the $\beta = .1$ level needed to indicate even a weak relationship. The same is true of Level, although it is significant, $\beta = -.012$ does not indicate that it is a strong relationship – see Table 2

13. Discussion

This paper sheds light on a critical issue which has been left largely uninvestigated in online learning: the impact of poverty and other risk factors on the access to, and success in, online education programs. It has been addressed to some degree in previous papers concerning specific courses (Hughes et al., 2007) or examined in congruence with a larger theme (Chang & Kim, 2009). However, course factors and demographic factors do not fully account for access to online education and success in online courses. Rather, decisions to pursue an online learning program, and the subsequent success or failure in that program, appears to be largely determined by the student's economic situation.

Table 2
Logistic multivariate regression.

Logistic regression analysis of 12,980 students in the SCVSP						
Predictor	β	SEβ	Wald	*P*	dfP	Odds ratio
Constant	−0.516	0.077	−6.640	0.000	4	0.596
SPI	−0.013	0.001	−19.300	0.000	4	0.986
Level	−0.012	0.025	−0.470	0.635	4	0.987
n Days	0.013	0.000	45.650	0.000	4	1.013
Eth	−0.275	0.029	−0.943	0.000	4	0.759

Reasons for this may include the different needs of At-Risk students, coupled with the different interaction types of online learning. The fact that one-on-one interactions are more frequent in an online environment than in a traditional classroom would lead one to assume that At-Risk students would perform on par with their non-At-Risk peers. Given the results of this study, this is not the case. The reasons for this are presumed to deal with the factors associated with risk, i.e. poverty associated with lack of regular access to online technology.

The results reinforce results support the idea that motivation, parents' involvement, and technology skills are the possible causes of student's success in online education programs. Previous studies have found that these factors are important with regards to access. While this study showed a very slight positive relationship between a lower poverty index and student success, it also goes to address the question of self selection in online learning. The findings from previous works by Hughes et al. (2009), Clark (2001), and Chang and Kim (2009) would seem to indicate that this self selection separates students based on risk factors, not only in access to online learning, but also ability due to limited previous experience.

13.1. Question 1: is there a difference between students who complete a course and those who drop a course based on poverty index?

This paper sought to answer two research questions. With regards to the first question, is there a difference with regards to poverty index between students who withdraw from a course and those who complete a course? Given the social factors surrounding high poverty students, one is led to question whether or not the students who stay enrolled in an online class are in fact high poverty or At-Risk students – or if they simply have indicators for At-Risk. Simply examining a population count of students from high poverty districts appears to confirm the notion that students from high poverty schools are less apt to attempt online courses. This is further supported by the significant difference in poverty indices between those students who stay and those who withdraw.

The results indicate that there is a significant difference between these two groups of students. The School Poverty Index for those students who completed a course was 4.27% lower than those students who chose to drop a class. However, if one considers that students in the SCVSP are generally from schools with lower poverty indices than the State average, then the impact of school poverty on whether a student chooses to stay in a course becomes more apparent. Specifically, students from low poverty schools should appear to perform better because the population consists of lower poverty students. In terms of usage the population follows what would be tautologically expected – students from high poverty districts are less likely to utilize online learning. The significant difference between the population who drop and those who completely appear to support the idea that online learning is in fact a toll good, i.e., high poverty students are kept from enrolling by situation and experience, ergo online learning is excludable. It is not excludable to the same degree that access to municipal water services or cable television is excludable, obviously those are transactions. However, it is excludable to the degree that prior ability and access to technology – which is a function of income – are determinates for access.

13.2. Question 2: what are the impacts of risk factors on success in an online course?

To answer the question of the impact of risk factors, the author used a logistic multivariate regression analysis which considered School Poverty Index, Course Level, number of days in the course and a dummy variable for the student's ethnicity. According to the model the log odds of a student passing a course in the SCVSP was negatively related to SPI ($p < .01$) and Eth ($p < .01$) but positively related to n Days ($p < .01$). Level did not show a significant relationship ($p = .635$). This means that the lower the poverty level the more likely a student will be to successfully complete a course. However, this is not a strong relationship, as it does not approach the $\beta = .1$ level needed to indicate even a weak relationship. The same is true of Level, although it is significant, $\beta = -.012$ does not indicate that it is a strong relationship – see Table 2.

The fact that SPI is significant is to be expected given both the previous mention of overall population with regards to poverty. If one considers performance of At-Risk students in a traditional school as indicative of their performance in an online course, then one would not expect them to excel in online learning. However, the weakness of the relationship is also of note, especially since Home and Private School students (SPI = 0.00) were removed. This goes to reinforce that poverty and other risk factors reduce the likelihood of At-Risk students self-selecting to take an online course, and that At-Risk students are more likely to drop the course if they enroll.

Fig. 2 shows the enrollment in SC for high schools per poverty level; Fig. 3 shows the enrollment in the SCVSP per poverty index. Two factors become immediately apparent. First is the level of poverty in South Carolina high schools. More than 60% of all high schools are over 68% poverty level. Second is the fact that enrollment in the SCVSP is right skewed, $sk_g = 2.6$; when Home School and Private School students are removed ($sk_{g-Home+Priv}$), the skew shifts to .16 but is still right skewed. This indicates that a larger percentage of students in the SCVSP are
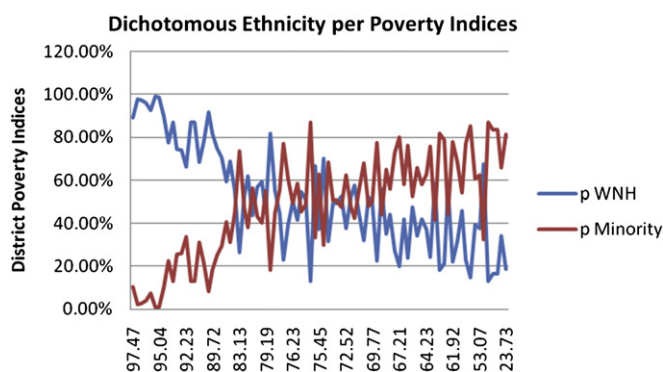

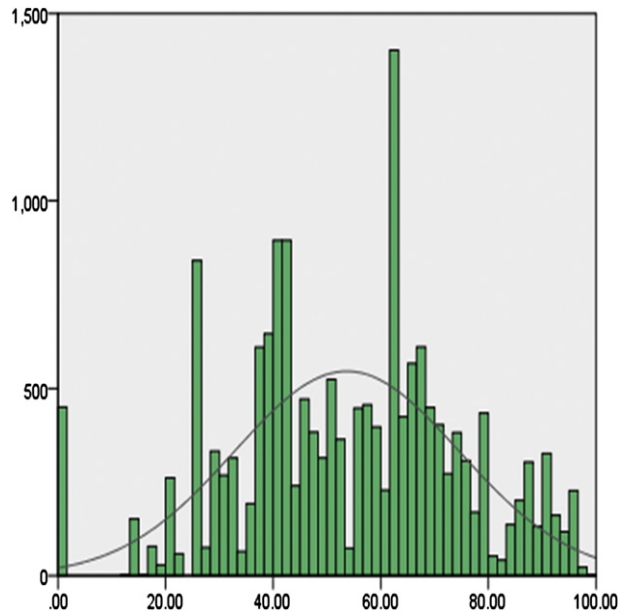**Fig. 2.** Dichotomous ethnicity per poverty index – 2009 data.

Fig. 3. Enrollment in SCVSP per poverty index. $\mu_{SCVSP} = 54.3$; $\mu_{Dept.\,of\,Education} = 63.5$; $sk_g = 2.6$; $sk_{g-Home+Priv} = 0.16$.

from the lower poverty schools (Fig. 4). Taken together, these two serve as an indication that what would seem anecdotally true, that students from higher poverty schools are less likely to take online courses, is in fact the case.

This paper sought to establish that online education as a choice option is a toll good rather than a merit good. Even in a state where every high school has access to technology and is wired for Internet access, high poverty students are excluded, or exclude themselves, from taking online classes. The question then becomes, what is the specific impact of this difference? The findings indicate that students in high poverty districts can be broadly categorized as underperforming in online courses in relation to their counterparts from low to median poverty districts. This relationship is categorized as "broad" because the sample of students who actually completed a course was significantly different than those who enrolled for a course. The significance of this relationship is most likely low because the population of high poverty students within the SCVSP is not a good representation of the high poverty population in the State of South Carolina.
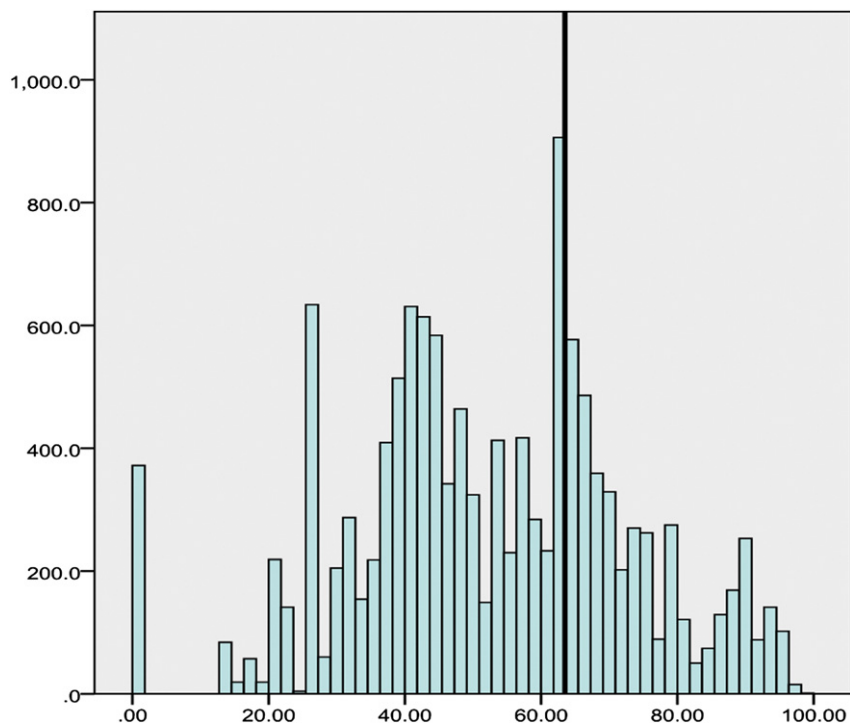

Fig. 4. Sample SCVSP poverty indices. $\mu_{Pass} = 52.4$, n above $\mu_{Dept.\,of\,Education} = 4{,}001$ ($p = 31\%$); $sk_g = 2.5$; $sk_{g-Home+Priv} = 0.14$.

This paper offers several considerations for future research. Among these are the impact of specific forms of teacher–student interaction in the online environment and the impact on volitional competence. Previous studies have noted that teacher interaction with a student in the online environment has a longer lasting effect than that in a traditional classroom. It would be interesting to examine what types of interactions have the longest lasting effects and which contribute the most to reasoned discussion of course material. In addition to questions of practice, the impact of peer effects in an online environment needs to be examined (Hanusheck, Kain, Markam, & Rivkin, 2003). Peer effects have been shown to have a direct impact on student achievement in the traditional classroom. The asynchronous nature of communication in the virtual classroom and thus the capacity for indirect interactions among peers makes this a question which is both interesting and relevant.

A limitation of this study is the fact that it examines a single case. While the case is interesting given the low educational attainment of South Carolina relative to other states, while the State's virtual school program is rated number two in the country, it is still a single case. This study could have been improved if individual student data were available rather than school level data. Longitudinal data on individual students were not available. This would have made the analysis more robust to the consideration of "At-Risk." Specifically, factors of parent's education level, previous educational attainment and previous technology experience should be examined.

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