

Accessing Trends, and Measuring Sexual and Location Disparities of the Performance of National Examination Examinees: The case of Amhara Regional State Grade Ten Students

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Abstract

Background: Examinations are given to certify and select candidates for higher educations. The Ethiopian General Secondary Education Certificate Examination (EGSECE) was administered from 2001 to 2019. This study was done on grade ten students' results who were taken the EGSECE exams in Amhara region 2001 to 2017. The purpose of this research was to see the trends of absolute and relative measures of the national exam sitters and passers, and evaluate sexual and locational disparities of their performances.

Method: The researchers would use retrospective research design and adopted multi stage cluster random sampling. Students were the primary units while Zones where their schools found were secondary. All grade ten students registered to take the EGSECE exam in each year in several high schools found in different administrative zones of the region were our sample. To analyze the data, the researchers used trend and variance analysis.

Results: Though the numbers of EGSECE exams sitters in the region were increased year to year, the relative numbers of passers were very low. The researchers found the gap between the trends of the numbers of students registered and took the national examinations were narrow. As time increased, the area between the trends of the numbers of students took the national exam and those got pass mark became wider. The trends of the promotion rates were the mirror images of the repetition rates. As time goes, the areal gap between the trends of the promotion rates of males and females became narrow. The mean promotion rate differences between male and female students were significant. Also, the average promotion rate differences of students among their administrative zones were significant.

Conclusion: In Amhara region little information exists on trend analysis of national exam results of students, and comparison of their mean promotion rates segregated by gender and zone. This research will enable the regional and zonal education bureau and woreda education offices to predict the future movement of its student's national exam performances, measure gender and location disparity, and perceive quality and internal efficiency of the education system in the region, zone and woreda.

Keywords: Accessing Trends; Egsece; Performance Of National Examination Examinees; Sexual And Locational Disparities; Variance Analysis

Introduction

Education is a process that helps to develop the social and economic status of a given society [1]. It is a fundamental instrument in the poverty alleviation process of any country. Education as an essential means for developing human resource and proper utilization of natural resource has become critical for social and economic development and poverty reduction.

As stated by the Ministry of Education, education helps human

beings to change as well as develop and conserve environment for the purpose of all rounded development by diffusing Science and modern technology in to the Society, and also it has great significance to understand and respect democratic and human rights [2]. It is a prerequisite for personal development of an individual and economic development of the Society as well for the country.

Examinations are given to certify completion of a program at a satisfactory level of achievement, and select candidates for higher

education, professional training, and thus, ultimately for employment. The prospect of the examination affects student's motivation to achieve, influencing the quality of his/her work; the test paper itself legitimizes the school's course of study and shapes what teachers do in the classroom; and the results form part of parents' evaluation of their children's schooling [3]. Though not always conclusive, examinations have powerful influences on individual's success in adult life. They also serve as a gauge of the quality of a nation's educational efforts and its workforce. Taxpayers and politicians use the results to estimate how well national resources have been spent, to measure the status and relative progress of regional, social, or ethnic group relative to another, and to compare their nation's educational level with that of other nations [3].

As Fig 1 shows from 2001 to 2019 the education structure of Ethiopia was composed of 3 years of pre-primary education, 8 years of

primary education (1st cycle: grades 1-4, 2nd cycle: grades 5-8), 2 years of general secondary education (grade 9-10), 2 years of preparatory secondary education, and higher education (college or university) [4].

School year starts on the 13rd of September and ends in the first week of July. The school year is divided into 2 terms with September to January as Term I and February to July as Term II. Schools are in vacation in January (2 weeks) and in July and August (2 months). From 1998 to 2019 upon completion of grades 8, 10, and 12, students take the education completion certificate examinations and are allowed to proceed to the next stage based on performance in the examinations [5].

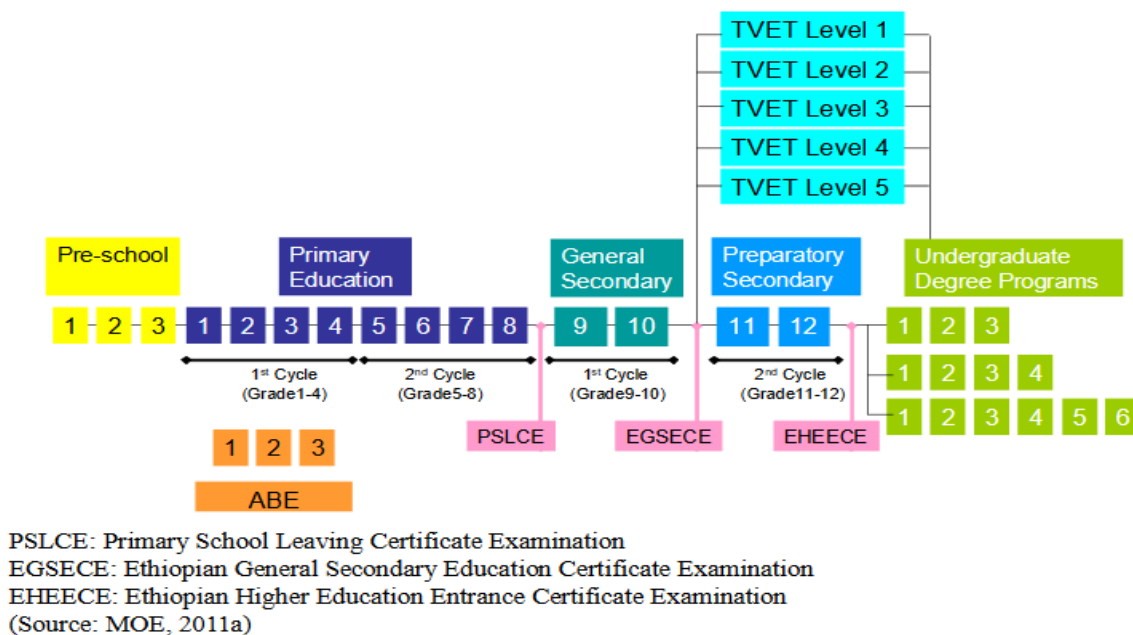


Figure 1: Structure of the Ethiopian Education System 1995 to 2019

The EGSECE was administered for the first time at a national level to regular students who completed grade 10 by the year 2001 on the basis of the new curriculum designed to general secondary education (grades 9 and 10). The General Secondary Education Certificate Examination included 9 exams on academic subjects (i.e., Amharic, English, Mathematics, Biology, Chemistry, Physics, Geography, History, and Civics), 4 exams on regional languages (i.e., Tigrigna, Afan Oromo, Harari and Anguak) and 2 others on Geez and French Language [6].

This study focusses on the number of grade 10 students sitting for and passing the Ethiopian General Secondary Education Certificate Examination (EGSECE). The National Examination was typically administered in May and June of each year. For each of nine subjects in the EGSECE on which students are tested, they are assigned a score ranging from 0.0 to 4.0. To achieve a grade of A or

4.0 for a single subject, for example, a student's raw score (number of questions answered correctly) must be at least two standard deviations above the mean score achieved for all students in that subject. A grade of B or 3.0 would be given to a student whose score in a subject is between one and two standard deviations above the mean. To determine an overall grade point average (GPA), scores in English and mathematics, which are compulsory subjects, plus a student's five highest scores from among the other subjects are added and then divided by seven. That process provides an overall composite score, which also ranges from 0.0 to 4.0. A GPA of 2.0 represents a passing score on the EGSECE [7].

The EGSECE is thus a norm-referenced assessment. Such assessments indicate how a student has performed relative to other students taking the same test, but do not indicate whether a student has achieved a particular level of proficiency or competence in the

subjects tested. Ethiopia's National Educational Assessment and Examinations Agency (NEAEA) prepared the EGSECE each year. Scores on the examination determine receipt of a grade 10 completion certificate as well as eligibility for advancement to grade 11 and the university track [7].

Even though the numbers of secondary schools and EGSECE exams sitters in Amhara Regional State were increased, the numbers of passers in EGSECE exams were very low. In 2015 from all students taking EGSECE only 34% were got the access to join the upper secondary school. Even there was a school only 3 students got pass mark in their EGSECE exams to join their preparatory program. That is very worrisome by any standard and it warrants in investigating the movements of the national exam passers from year to year and measure the sexual and locational disparities concerning the students EGSECE performances.

Comparison of student's achievement can be done in terms of many variables of which some of them are locations and students sex. Pillow has examined the gender differences among student on their academic performance has reveal that in individuals background characteristic affect his/her cognitive and non-cognitive was one of the most significant and influential characteristics in academic performance [8]. Nori studied the sex differences and the relationship between creativity and self-concept on academic performance among high school students [9]. However, a study on Spanish student indicated that some differences exist between males and females on aspect of creativity related to academic achievement, although creativity is shown to be related to academic performance for gender. Ai also found that the degree of creativity between male and female is similar but they also concluded that the most famous creative persons are usually male. Some researcher reported that one gender is more creative than another gender [10].

Taking the above background information about EGSECE exam sitters and passers, and literatures into consideration this research was conducted to achieve the accompanying objectives: Accessing trends, and measuring sexual and location disparities of the EGSECE exam results in Amhara Regional State students, and tried to address the following research questions.

- What does the pattern of the trend of the promotion rate of grade ten students who took national examinations in Amhara region from 2001 to 2016 look like?
- Do the trends of the promotion rates of grade ten students who took national examinations in Amhara region from 2001 to 2016 similar for both sexes?
- Do the average promotion rates of grade ten students who took national examinations in Amhara region from 2001 to 2016 at different administrative areas of the region the same?
- Do the average promotion rates of grade ten students who took national examinations in Amhara region from 2001 to 2016 the same for both sexes?

Material and Methods

Data Source

Education administration in Ethiopia is generally controlled by the ministry of education at the federal level and education bureau at the regional levels. In Amhara Region schools are controlled by Woreda Education Offices; Woreda Education Offices in turn controlled by Zonal Education Bureaus and Zonal Education Bureaus are controlled by Regional Education Bureau. So, for this research the data were obtained from Zonal and Regional Education Bureaus.

Research Design

Since the researchers used passed data and make comparison for performances of students between males and female students, and among their administrative zones the research design in this study was case control study design.

Sampling Design

Based on the nature of the study population in our research, we adopted the multi stage cluster random sampling where the stages were the administrative zones, schools and the students even if we did not consider the school effects. Students were the primary units while their administrative Zone where their schools found were the secondary units. All grade ten students registered to take the EGSECE exam in each year in several high schools found in the different administrative zones of the region were our sample.

Method of Data Analysis

In fact, the research method is the conceptual structure within which research is conducted; it constitutes the blue print for measurement and analysis of data. For this study to analyze the data we have used the following statistical methods:

Trend Analysis

Trend analysis is one of the technical ways of predicting the future movement of any measurement. The trend analysis usually uses time series observations over a significant period to predict the future behavior of that observation. A time series is an ordered sequence of observation. Although the ordering is usually through time, particularly in terms of equally spaced time intervals, the ordering may also be taken through other dimensions, such as space. For our study data the ordering is through time (year) [11].

Two way Completely Randomized Design

A design is the rule that determines the assignment of the experimental units to treatments. The simplest possible design is the completely randomized design, where the experimental units are assigned to the treatments completely at random, subject to the number of observations to be taken on each treatment. Completely randomized designs involve no blocking factors. Two ways completely randomized designs involve two factors say factor **A** with treatment levels **a** and factor **B** with treatment levels **b**. We use r_i to denote the number of observations to be taken on the first treatment, r_j be the number of observation to be taken on the second observation and $n = \sum_{j=1}^b \sum_{i=1}^a r_{ij}$ to denote the total number of ob-

servations (and hence the required number of experimental units). We code the treatments from 1 to ab and label the experimental units 1 to n[12].

Model for Completely Randomized Design

A model is an equation that shows the dependence of the response variable upon the levels of the treatment factors. Let Y_{ijt} be a random variable that represents the response obtained on the t^{th} observation of the i^{th} and j^{th} treatment. Let the parameter μ_{ij} denote the “true response” of the i^{th} and j^{th} treatment, that is, the response that would always be obtained from the i^{th} and j^{th} treatment if it could be observed under identical experimental conditions and measured without error. Of course, this ideal situation can never happen—there is always some variability in the experimental procedure even if only caused by inaccuracies in reading measuring instruments. Sources of variation that are deemed to be minor and ignored during the planning of the experiment also contribute to variation in the response variable. These sources of nuisance variation are usually represented by a single variable ϵ_{ijt} , called an error variable, which is a random variable with zero mean. The model is then

$$Y_{ijt} = \mu_{ij} + \epsilon_{ijt}, i=1,2,\dots,a \quad j=1,2,\dots,b \quad t=1,2,\dots,r_{ij} \quad (1)$$

where a is the number of treatments in factor A, b is the number of treatments in factor B and r_{ij} is the number of observations to be taken on the ij^{th} treatment combination. An alternative way of writing this model is to replace the parameter μ_{ij} by $\mu + \tau_{ij}$, so that the model in equation 1 becomes

$$Y_{ijt} = \mu + \tau_{ij} + \epsilon_{ijt}, i=1,2,\dots,a \quad j=1,2,\dots,b \quad t=1,2,\dots,r_{ij} \quad (2)$$

In Equation 2, $\mu + \tau_{ij}$ denotes the true mean response for the ij^{th} treatment combination, and examination of differences between the parameters μ_{ij} in Equation 1 is equivalent to examination of differences between the parameters τ_{ij} in Equation 2 (Dean et al., 1999).

In Equation 2 the parameter μ is a constant, and the parameter τ_{ij} represents the positive or negative deviation of the response from this constant when the ij^{th} treatment is observed. This deviation is called the “effect” on the response of the ij^{th} treatment (Dean et al., 1999).

Since the interaction from a two-factor experiment may be aroused, it is often useful to model the effect on the response of treatment combination ij to be the sum of the individual effects of the two factors, together with their interaction; that is,

$$\tau_{ij} = \alpha_i + \beta_j + (\alpha\beta)_{ij} \quad (3)$$

Here, α_i is the effect (positive or negative) on the response due to the fact that the i^{th} level of factor A is observed, and β_j is the effect (positive or negative) on the response due to the fact that the j^{th}

level of factor B is observed, and $(\alpha\beta)_{ij}$ is the extra effect (positive or negative) on the response of observing levels i and j of factors A and B together. The corresponding model, which we call the two-way complete model, or the two-way analysis of variance model, is as follows:

$$Y_{ijt} = \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijt} \quad (4)$$

The error variables represent all the minor sources of variation taken together, including all the measurement errors. In many experiments, it is reasonable to assume that the error variables are independent and that they have a normal distribution with zero mean and unknown variance σ^2 , which must be estimated. We call these assumptions the error assumptions. Proceeding with the analysis when the constant variance, normality, or independence assumptions are violated can result in a totally incorrect analysis. Thus, for a two way completely randomized design with ij specifically selected treatments (fixed effects) combination, in Equations 1, 2 and 4 the ϵ_{ijt} 's $\sim N(0, \sigma^2)$, and they are mutually independent. Notice that it is unnecessary to specify the distribution of Y_{ijt} in the model, as it is possible to deduce this from the stated information. Since Y_{ijt} is modeled as the sum of a treatment mean $\mu + \tau_{ij}$ and a normally distributed random variable ϵ_{ijt} , it follows that Y_{ijt} 's $\sim N(\mu + \tau_{ij}, \sigma^2)$ and also, since the ϵ_{ijt} 's are mutually independent, the Y_{ijt} 's must also be mutually independent [12].

Computer Software Used To Analyze The Data

Data analysis software is a tool that is used to process and manipulate information, analyse the relationship and correlation between the dataset by providing quality analysis like transcription analysis, discourse analysis, grounded theory methodology and content analysis, and decision-making methods using the statistical and analytical capabilities. For our research we have used the accompanying tools:

- Excel
- R software version 4.0.3

Results

Results Of Trend Analysis

Ethiopian general school leaving certificate examination was started in 2001. Trend analysis is one of the technical ways of predicting the future movement of any measurement. As per Fig 2 shows the trend of the numbers of grade ten students registered, examined and promoted to the next class from 2001 to 2016 in the region grew high and high from year to year. However, even if the gap between the trends of the numbers of students took the national exam and the numbers of students registered were narrow, the figure shows that as time went up the disparity between the numbers of students took the national exam and the numbers of students promoted the national exam came to be wider.

Number of grade ten students registered, examined and got pass mark for EGSECE in Amhara Region 2001 to 2016

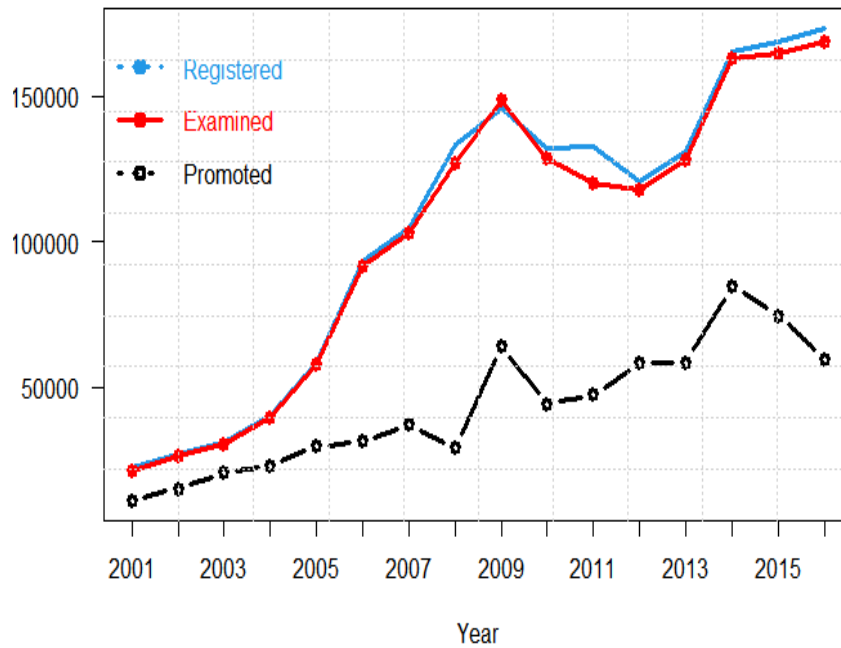


Figure 2: Line graph of numbers of grade ten students enrolled, examined and got pass mark for the EGSECE exam in the Amhara region 2001 to 2016

As we saw the trend analysis for male and female grade ten students separately in Fig 3, the trend of the numbers of male and female students took the national exam in the region grew steadily until 2009, from 2009 to 2012 the trend declined and from 2012 to 2016 it grew up for both sexes. Fig 3 also shows that until 2010

the numbers of male students took the national exam were above that of females, from 2011 to 2013 the number leveled off for both sexes while from 2013 to 2016 the trend of female students took the exams were above that of males.

Numbers of grade ten students took EGSECE exam in Amhara Region 2001 to 2016 by sex



Source: Zonal Education Bureaus

Figure 3: Line graph of the numbers of grade ten students took the EGSECE exam by student sex 2001 to 2016

When we saw the trend of grade ten national examination exams passers from 2001 to 2016 in the region by student sex separately, Fig 4 indicates that until 2009 the trend grew up by swinging up and down for both sexes, from 2009 to 2011 for males and from 2009 to 2010 for females the trend grew down. In addition, the figure shows from 2011 to 2014 for males and from 2010 to 2014 for females the trends of the numbers of the national exam passers

grew up, and from 2014 to 2016 the trend declined for both sexes. Besides Fig 4 displays that even though the trends of the numbers of male passers in the national examination in the region from 2001 to 2013 were above that of female students, as time grew up the gap between the numbers of male and female passers were gradually narrowed and from 2015 to 2016 the females surpassed that of males.

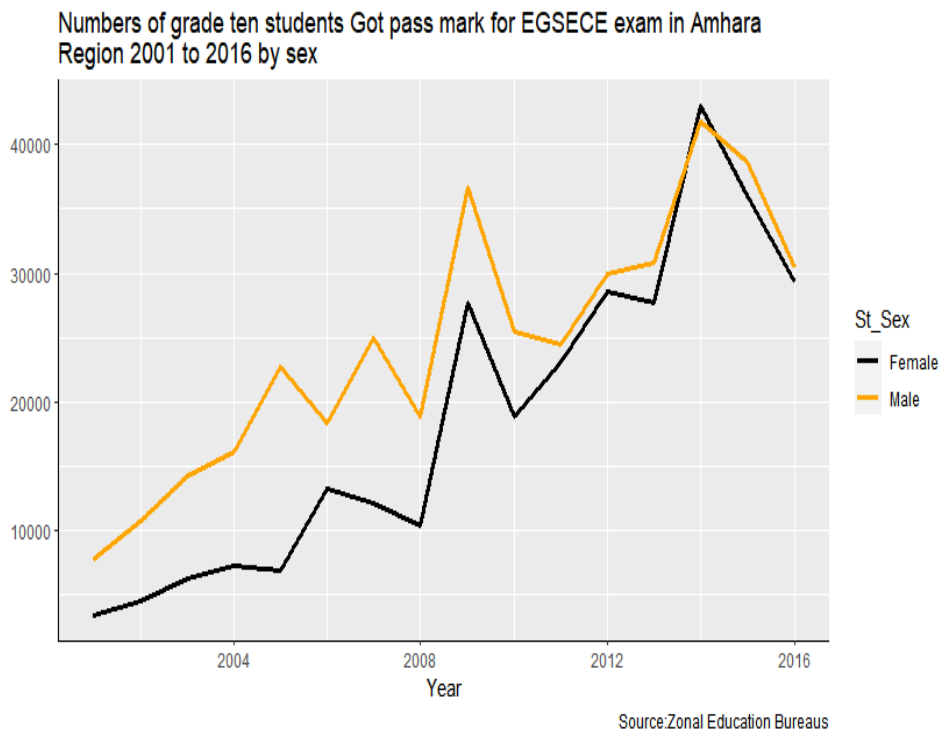


Figure 4: Time series plot of the number of grade ten regular students got pass mark in EGSECE exam in Amhara Region by sex 2001 to 2016

Unlike absolute numbers or methods, relative approaches are best measures of education indicators. Table 1 shows the flow rates of grade ten regular students in Amhara region taking the EGSECE exam from 2001 to 2016. This table shows that in the region from 2001 to 2016 the minimum promotion, dropout and repetition rates respectively were 21.95, -0.9 and 32.27 percent per year while the maximum rates correspondingly were 65.88, 3.77 and 77.02 percent. Further Table 1 indicates the average promotion, dropout and

repetition rates in the time interval 2001 to 2016 respectively were 44.31, 1.09 and 54.6 percent with a respective standard deviation of 11.3, 0.96 and 13.36 percent per annum. Also, Table 1 reveals that on average from 100 grade ten students registered in the region from 2001 to 2016 G.C 44 of them got pass mark for the national examination, 55 of them were repeated and only 1 of them was dropout its class annually.

Table 1: Summary vales of flow indicators of grade ten regular students registered in Amhara Region to take EGSECE exam from 2001 to 2016

Five number summaries including mean and standard deviation		Flow indicators			
		Percentage promoted	Promotion Rate	Dropout rate	Repetition rate
❖	Minimum	22.98	21.95	-0.9	32.27
❖	First quartile	35.87	35.19	0.72	47.93
❖	Median	45.52	44.46	0.96	54.48
❖	Mean	45.4	44.31	1.09	54.6
❖	Third quartile	52.07	50.91	1.15	64.13
❖	Maximum	67.73	65.88	3.77	77.02
❖	Standard deviation	13.36	11.30	0.96	13.36

When we considered the summary statistics of the flow rates for male and female students separately, Table 2 shows that in the region from 2001 to 2016 the minimum promotion, dropout and repetition rates for males and females respectively were 24.74 and 18.21, -0.58 and -1.28, and 26.4 and 42.65 percent per year while the maximum rates correspondingly were 71.97 and 55.26, 6.52 and 2.09, and 74.11 and 80.92 percent. Further Table 2 indicates in the time interval 2001 to 2016 the average promotion, dropout and repetition rates for males and females respectively were 47.5 and

39.55, 1.52 and 0.65, and 50.98 and 59.79 percent with standard deviation of 13.47 and 9.7, 1.55 and 0.68, and 13.5 and 9.84 percent in that order for males and females per annum. Besides Table 2 reveals that on average from 100 grade ten male and female students registered in the region from 2001 to 2016 respectively 47 and 39 of them got pass mark for the national examination, 51 and 60 of them were repeated and only 2 and 1 of them was dropout their class annually.

Table 2: Summary vales of flow indicators of grade ten students registered in Amhara Region to take the EGSECE exam from 2001 to 2016 separated by student sex

Five Number Summaries including mean and standard deviation		Flow indicators							
		Percentage promoted		Promotion Rate		Dropout rate		Repetition rate	
		Male	Female	Male	Female	Male	Female	Male	Female
❖	Minimum	25.89	19.08	24.74	18.21	-0.58	-1.24	26.40	42.65
❖	First quartile	39.72	34.9	36.19	34.14	0.95	0.48	39.89	54.37
❖	Median	47.99	39.36	46.56	39.09	1.23	0.77	52.01	60.64
❖	Mean	49.02	40.21	47.50	39.55	1.52	0.65	50.98	59.79
❖	Third quartile	60.11	45.63	59.56	44.70	1.46	0.93	60.28	65.10
❖	Maximum	73.60	57.35	71.97	55.26	6.52	2.09	74.11	80.92
❖	Standard deviation	13.5	9.84	13.47	9.7	1.55	0.68	13.5	9.84

In addition to summary values line graphs are very important descriptive statistics to see the trend of indicators. Indicating the trend of the flow rates of grade ten students in Amhara region registered for the national examination from 2001 to 2016, Fig 5 shows that the minimum promotion rate was recorded in 2008 while the maximum rate was documented in 2003. Further Fig 5 implies that the dropout rate was level of at a constant rate, and the promotion rate

was the mirror image of the repetition rate with a decreasing trend. In addition, Fig 5 shows that the trend of the promotion rate was increased for the first two years, decreased down ward from 2003 to 2008, raised upward from 2008 to 2014, declined down for the rest two years and moved a general down ward direction throughout the time interval of 2001 to 2016.

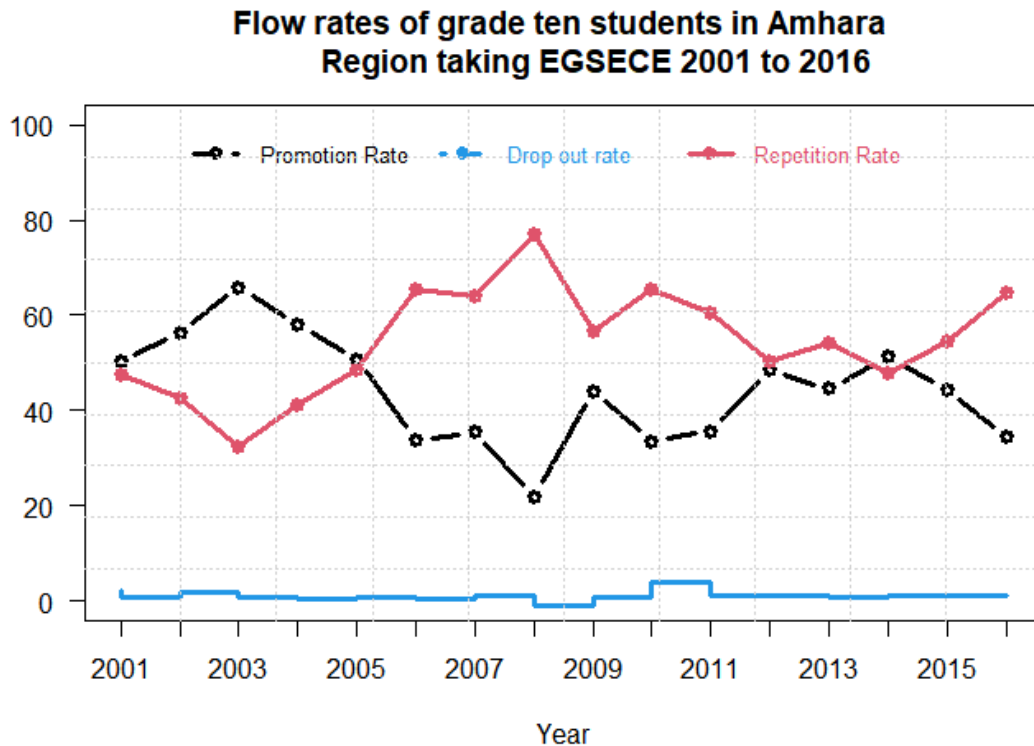


Figure 5: Time series plot of the flow rates of regular grade ten students took EGSECE exam in Amhara region 2001 to 2016

Seeing the trend of the promotion rate of male and female students separately, Fig 6 shows that the minimum promotion rate of male and female students was recorded in 2008 while the maximum rate was documented in 2003 for both sexes. In addition, Fig 6 shows that for the two sexes, the trend of the promotion rate was increased for the first two years, from 2003 to 2006 for males and from 2003 to 2008 for females the trend declined down, from 2006 to 2011 the trend of the promotion rate of males were swinging while from 2008 to 2014 the trend of females raised upward, and for the remaining years for both sexes the trend declined down.

Further Figure 6 shows that for the year 2006, 2011, 2012 and 2014 the promotion rate of females surpassed that of males while for the remaining years the male rates exceeded that of females. Besides Fig 6 shows that even though the promotion rates of male students exceeded that of females for most of the time periods, as time grows up the gap between the promotion rate of males and females became narrow. In general, the graph shows that for both sexes though the time interval of 2001 to 2016 the pattern of the promotion rates of students were a decreasing trend.

Promotion rate of grade ten students Got pass mark for EGSECE exam in Amhara Region 2001 to 2016 by sex



Source: Zonal Education Bureaus

Figure 6: Time series graph of the promotion rate of grade ten students got pass mark for the EGSECE exam in Amhara region 2001 to 2016 by student sex

Analysis of Variance Results

Analysis of variance (ANOVA) is a statistical tool used to detect differences between experimental group means. ANOVA is warranted in experimental designs with one dependent variable that is a continuous parametric numerical measure, and multiple experimental groups with one or more independent (categorical) variables. In ANOVA terminology independent variables are called treatment factors or simply treatments or factors, groups within each treatment factors are referred to as levels, and the number of times each subject are assigned to a factor and measurement is taken on each subject is called replication. In this research the response variable was the promotion rate of grade ten students registered in Amhara region to take the EGSECE exam from 2001 to

2016 while the explanatory variables were students’ administrative zone in the region and their sexes, and the data were recorded for sixteen years.

In ANOVA before conducting the analysis it is recommended to see whether there were variations among the treatment means. One of such a technique is adopting box plots. Fig 7 shows the box plot of promotion rate of grade ten students in the Amhara region from 2001 to 2016 take the national examination separated by students’ sex and their administrative zone. This plot indicates that there seemed treatment means variation among the different combinations.

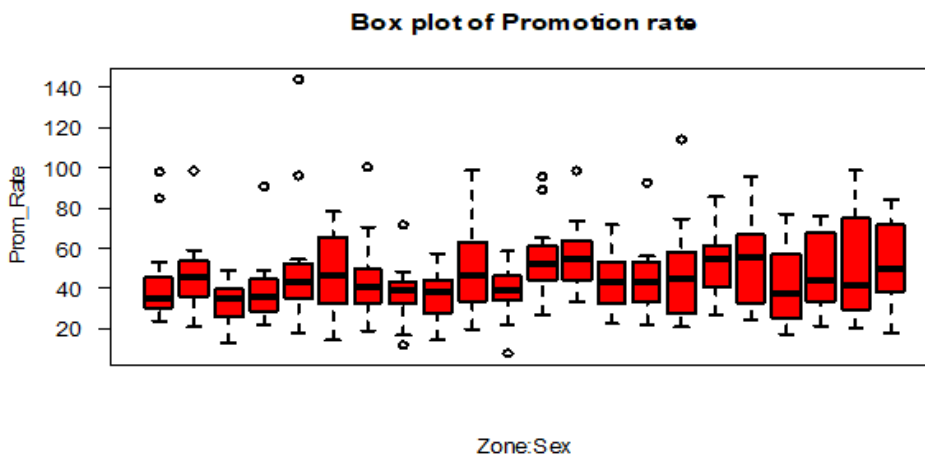


Figure 7: Box plot of the promotion rate of grade ten students registered in Amhara region separated by zone and students’ sex 2001 to 2016

To check whether the result shown in Fig 7 was statistically significant or not, we used the analysis of variance with two factors: student sex and their administrative zone where they registered to take their national exams. At 5% risk or with 95% confidence, the result shown in Table 3 indicates that in the time interval of 2001

to 2016 there were a significant mean promotion rate differences of students across their administrative zone where they took their EGSECE exams (p-value = 0.027321), between their sexes (p-value = 0.0008) but the interaction effect (p-value = 0.792425).

Table 3: ANOVA table of the promotion rate of grade ten students registered in Amhara region grouped by student sex and zone 2001 to 2016a

Source of Variation	Degree of freedom	Sum square	Mean Square	F value	Pr (>F)
• Zone	10	7407	741	2.059	0.027321 *
• Student Sex	1	4113	4113	11.431	0.0008 ***
• Zone: Sex	10	2249	225	0.625	0.792425
• Residuals	330	118729	360		

Table 4 and Fig 8 show that in the year 2001 to 2016, the average promotion rate per annum of grade ten students' of Oromia Liyu Zone, Bahir Dar city administration, Waghemra, South Gondar, North Wollo and Awi zones were above the regional average while the mean promotion rate of the students in West Gojam, Semen Shoa, North Gondar, South Wollo and East Gojjam administrative zones were below the regional mean promotion rate. Besides Table 4 and Fig 8 also indicate that in the year 2001 to 2016 the average

promotion rate per annum of grade ten male students were above the regional average while for female students it was below the mean promotion rate of the region. Further Table 4 and Fig 8 point out that in the year 2001 to 2016 the two highest average promotion rates per annum of grade ten regular students were recorded in Oromia Liyu zone and Bahir Dar city administrative while the two minimum mean promotion rates were documented in South Wollo and East Gojjam zones.



Figure 8: Main effects plot of average promotion rate of grade ten students registered in Amhara region to take the EGSECE exam separated by their sex and administrative zone 2001 to 2016

Table 4: Mean promotion rate of grade ten regular students registered in Amhara region to take the EGSECE exam separated by their sex and administrative zone their school found 2001 to 2016

Zone	Student Sex		Total
	Female	Male	
Awi	42.62	54.34	48.48
Bahir Dar City	46.30	55.47	50.89
East Gojam	33.45	43.77	38.61
North Gondar	38.29	44.21	41.25
North Wollo	50.11	47.95	49.03
Oromia Liyu Zone	49.61	52.33	50.97
South Gondar	44.73	54.06	49.4
South Wollo	37.27	40.99	39.13
Semen Shoa	36.80	47.68	42.24
Waghemra	50.46	49.87	50.16
West Gojam	38.45	52.60	45.52
Total	42.55	49.39	45.97

Discussion

Academic performance is the measurement of students' achievement across various academic subjects. Teachers and education officials typically measure achievements using classroom performance, graduation rates, and results from standardized tests. In Ethiopia from 2001 to 2019, EGSECE exams were one of the standardized national exams given to grade ten students for each year, usually on the end of May or on the beginning of June. In this research, we tried to measure the movement of flow rates of the national exams takers and passers, and compared the promotion rates of the passers separated by students' sexes and locations.

In Amhara regional state from 2001 to 2016 the promotion rates of the EGSECE examinee students had a decreasing trend. This result was also true for male and female students separately. The result also revealed there were sexual and zonal variations in the national examinations performances of the students in the region.

The trend analysis of the numbers of grade ten students registered, examined and promoted to the next class from 2001 to 2016 in the region showed that from year to year the trend has increased. However, even if the gap between the trends of the numbers of students took the national exam and the numbers of students registered were narrow, the result discloses as time grew up the area between the numbers of students took the national exam and the numbers of students promoted the national exam came to be wider. This revealed that while the numbers of students dropping their class were so minimal the numbers of students repeating their grade were getting larger.

The trend analysis for male and female grade ten students separately revealed the trends of the numbers of male and female students took the national exam in the region grew steadily until 2009, from 2009 to 2012 the trend declined and from 2012 to 2016

it grew up for both sexes. The result also found that until 2010 the numbers of male students took the national exam were above that of females, from 2011 to 2013 the number leveled off for both sexes while from 2013 to 2016 the trend of female students took the exam were above that of males. When we saw the trend of promoted numbers of students to the next class from 2001 to 2016 in the region by student sex separately; the result point out until 2009 the trend grew up by swinging for both sexes, from 2009 to 2011 for males and from 2009 to 2010 for females the trend grew down. However, from 2011 to 2014 for males and from 2010 to 2014 for females the trends of the number of students passed the national exams were grew up, while from 2014 to 2016 the trend declined for both sexes. Besides the research result reveals that even though the trends of the numbers of male students got pass mark in the national examination in the region from 2001 to 2013 were above that of female students, as time grew up the gap between the numbers of male and female passer students were gradually narrowed and from 2015 to 2016 the females surpassed that of males.

In addition to absolute measures relative measure are very important in producing flow rates like promotion, repetition and dropout rates. The outcomes of this research found that the average promotion, dropout and repetition rates of grade ten students taking the EGSECE exam in the region in the time interval 2001 to 2016 respectively were 44.31, 1.09 and 54.6 percent with standard deviation of 11.3, 0.96 and 13.36 percent in the respective order per annum. The research result also revealed that on average from 100 grade ten students registered in the region from 2001 to 2016 to take the EGSECE exam, 44 of them got pass mark for the national examination, 55 of them were repeated and only one of them was dropout its class annually. While observing the flow rates of the students taking the national exam in the region across the different sexes in the time interval of 2001 to 2016; the average promotion, dropout and repetition rates for males and females respectively

were 47.5, 1.52 and 39.55, and 50.98, 0.56 and 59.79 percent with standard deviation of 13.47, 1.55 and 9.7, and 13.5, 0.68 and 9.84 percent in that order for males and females per annum. Besides the result revealed that on average from 100 grade ten male, and female students registered in the region from 2001 to 2016 respectively 47 and 39 of them got pass mark for the national examination, 51 and 60 of them were repeated and only 2 and 1 of them was dropout their class annually. This result also discovered that while the average promotion rate of male students was above to that of the regional average promotion rate, the females' average promotion rate was below it, and the reverse result was true for the average repetition rate for male and female students. The research outcome showed that the minimum promotion rate of grade ten regular students taking the EGSECE in Amhara region in the time interval of 2001 to 2016 was recorded in 2008 while the maximum rate was documented in 2003. This result was also true for male and female students separately.

The research outcome showed that the trend of the promotion rate was increased for the first two years, decreased down ward from 2003 to 2008, raised upward from 2008 to 2014, declined down for the rest two years and moved a general down ward direction throughout the time interval of 2001 to 2016. Also, the research outcome revealed that even though the promotion rates of male students exceeded that of females for most of the time periods, as time grows up the gap between the promotion rate of males and females became narrow. In general, the research outcome found that for both sexes throughout the time interval of 2001 to 2016 while the promotion rates of grade ten students taking the EGSECE exams had a decreasing trend, the trend of dropout rates were level of at a small constant rate.

In the time interval of 2001 to 2016 the result on the analysis of variance reveals that for grade ten regular students taking EGSECE exams in Amhara region there were a significant mean promotion rate differences between males and females (p -value = 0.0008). This result is in line with previous study done in Nigeria and in Iran, and by Pillow but contradicts with the study done by Ai in Spain. The research result pointed out that in the specified time interval the average promotion rate of grade ten regular students taking EGSECE exams in the region was 46 percent [8,9,10,13]. Comparing this result with that for males and females separately the research outcome revealed that in the study period the average promotion rate per annum of grade ten regular male students (49.39%) was above that of the regional average while for female students (42.55%) it was below the regional mean promotion rate.

In the study period the result on the analysis of variance also disclosed that for grade ten regular students taking EGSECE exams in Amhara region 2001 to 2016 there were a significant mean promotion rate differences across their administrative zones where their schools found (p -value = 0.027321). In the period the study unveiled that the average promotion rate per annum of grade ten regular students' of Oromia Liyu Zone, Bahir Dar city administration, Waghemra, South Gondar, North Wollo and Awi zones were

above the regional average while the mean promotion rate of the students in West Gojam, Semen Shoa, North Gondar, South Wollo and East Gojam administrative zones were below the regional mean promotion rate. Besides the findings also pointed out that in the time interval the two highest average promotion rates per annum of grade ten regular students in the region were recorded in Oromia Liyu zone and Bahir Dar city administrative zone while the two minimum mean promotion rates were documented in South Wollo and East Gojam zones. This might be education offices administrative problems since those zones with the minimum promotion rate are wide to allocate resources and recruit appropriate skilled human resources. Further in the study period the result on the analysis of variance disclosed that for grade ten students taking EGSECE exams in Amhara region there were no a significant mean promotion rate differences across the students' administrative zones where their schools found and their sex's interaction (p -value = 0.792425).

Conclusion

Though not always conclusive, examinations have powerful influences on individual's success in adult life. They also serve as a gauge of the quality of a nation's educational efforts and its workforce. Taxpayers and politicians use the results to estimate how well national resources have been spent, to measure the status and relative progress of regional, social, or ethnic group relative to another, and to compare their nation's educational level with that of other nations [3].

Our investigation focuses on grade ten students' results took the EGSECE exams in Amhara region from 2001 to 2016. In the trend analysis we found that the gap between the trends of the numbers of students registered and the numbers of students took the national examinations were narrow. As time increased the area between the trends of the numbers of students took the national exam and those got pass mark became wider and wider. The trend of the dropout rates was level off at a small constant rate and the trend of the promotion rates was the mirror images of the repetition rates with the decreasing trend. Even though the promotion rates of male students exceeded that of females for most of the time periods, as time grows up the areal gap between the trend of the promotion rate of males and females became narrow and narrow. From 100 grade ten students registered in the region from 2001 to 2016 to take the EGSECE exams on average only 44 of them got pass mark for the national examination, 55 of them failed and only one student dropped out its class respectively with standard deviation of 12, 14 and 2 students per annum. On average from 100 grade ten male, and female students registered in the region in the specified period respectively for males and females 47 and 39 of them got pass mark for the national examination, 51 and 60 of them were repeated, and only 2 and 1 of them was dropout their class annually. Also, the result revealed the minimum promotion rate of grade ten students taking the EGSECE exams was recorded in 2008 while the maximum rate was documented in 2003 and this result was also true for male and female students separately.

Our inquiry based on analysis of variance disclosed that for grade ten students taking EGSECE exams in the region from 2001 to 2016 there were a significant mean promotion rate differences between male and female students, among their administrative zones where they took the national exams but their interaction effects. Comparing the result for males and females separately the research outcome revealed that in the study period the average promotion rate per annum of grade ten male students was above that of the regional average while for female students it was below the regional mean promotion rate. In the stated period the study also unveiled that the average promotion rate per annum of grade ten students' of Oromia Liyu Zone, Bahir Dar city administration, Waghemra, South Gondar, North Wollo and Awi zones were above the regional average while the mean promotion rate of the students in West Gojam, Semen Shoa, North Gondar, South Wollo and East Gojam administrative zones were below the regional mean promotion rates. Besides the findings also pointed out that in the time interval the two highest average promotion rates per annum of grade ten students in the region were recorded in Oromia Liyu zone and Bahir Dar city administrative zone while the two minimum mean promotion rates were documented in South Wollo and East Gojam zones.

Even if the disparity between the trends of the numbers of students took the national exam and the numbers of students enrolled in the region in the year 2001 to 2016 were narrow, the result showed that as time went up the disproportion between the numbers of students took the national exams and the numbers of national examination passers became to be wider and wider. This implied that while the numbers of students dropping their class were so minimal, the numbers of students repeating their grade or failed the national examinations were getting larger and larger. Concerning the performance of grade ten students taking the national examinations in the region from 2001 to 2016, the result also revealed there were zonal and sexual disparity, and the quality and internal efficiency of the education system were deteriorated.

There were many researches done on students' performance in schools. Nevertheless, in Amhara region little information exists on trend analysis of EGSECE exam results of grade ten students and in comparing mean promotion rates of the EGSECE examinee students separated by their sexes and locations. By using trends, the regional education bureau can predict the future movement of its student's performance and can measure sexual disparity concerning their performance in national examinations results, and perceive quality and internal efficiency of the education system in the region. Generating valid indicators help for policy makers and officers which permit them for evaluation and monitoring of schools, teachers, programs, and students. Producing real education indicators also provide support for regional, zonal and woreda education bureaus and offices to measure the quality of education in the region or zone, measure gender and zonal disparity of the performance of students in their national exam results, and quantify the internal efficiency of the education system in the region as well as in the different administrative zones of the region.

School principals, unit leaders, teachers, families and communities are very important for the success of students in their national exams. However, because of time and budget constraint for this research we are not collect data from them directly. Also, budget allocated for education, political and financial corruption, political instability of the region, English language knowledge of students, drug addiction behavior of students, students cheating behavior in exams, unemployment rate in the region, living cost of households, and availability of electricity and road facilities impacted the students' performance in their EGSECE results. Yet in this research we have not seen their direct influences. In this research during analyzing the data using trend analysis and analysis of variance since Gondar and Dessie city administrations were started their zonal equivalence administrations in the region in 2011/ 2012 we ignore their effects and we included the registered, examined and promoted grade ten students in the cities respectively in North Gondar and South Wollo zones. Further in this research during analyzing the data using analysis of variance we have ignored the time effects. So, for future studies we recommend other models like panel data analysis techniques to see the time effect on the student's national examination results.

Acronyms

ANOVA	Analysis of Variance
EGSECE	Ethiopian General Secondary Education Certificate Examination
EHEECE	Ethiopian Higher Education Entrance Certificate Examination
ETB	Ethiopian Birr
Fig	Figure
IDCJ	International Development Center of Japan
JICA	Japan International Cooperation Agency
MOE	Ministry of Education
NEAEA	National Education Assessment and Examination Agency
Prom	Promotion
PSLCE	Primary School Leaving Certificate Examination
St	Student
WB	World Bank

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Compliance with Ethical Standards

• **Disclosure of potential conflicts of interest:** No potential competing interest was reported by the author.

• **Research involving Human Participants and/or Animals:** The study populations for this research were all grade ten students in Amhara Region registered from 2001 to 2016 to take the Ethiopian General Secondary Education Certificate Examination (EGSECE) exams. The data were obtained from Zonal and Regional Education Bureaus. For studies reporting research involving human participants, some publishers require authors to confirm that the specific study was reviewed and approved by institutional review board (ethics committee) before the study began. However, this specific study reporting a retrospective study of educational records obtained from the regional education bureau, and all data were fully anonymized. Hence participant consent was not informed and the specific study was not reviewed and approved by the university review board (ethics committee).

• **Informed consent:** This specific study reporting a retrospective study of educational records obtained from the regional education bureau, and all data were fully anonymized. Hence participant consent was not informed.

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Author Contribution

The authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by both the two researchers. The first draft of the manuscript was also written by the researchers.

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