

# Package ‘eefAnalytics’

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**Type** Package

**Title** Robust Analytical Methods for Evaluating Educational Interventions using Randomised Controlled Trials Designs

**Version** 1.1.3

**Description** Analysing data from evaluations of educational interventions using a randomised controlled trial design. Various analytical tools to perform sensitivity analysis using different methods are supported (e.g. frequentist models with bootstrapping and permutations options, Bayesian models). The included commands can be used for simple randomised trials, cluster randomised trials and multisite trials. The methods can also be used more widely beyond education trials. This package can be used to evaluate other intervention designs using Frequentist and Bayesian multilevel models.

**License** AGPL (>= 3)

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**BugReports** <https://github.com/germaine86/eefanalytics/issues>

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ComparePlot	<i>A plot function to compare different eefAnalytics S3 objects from the eefAnalytics package.</i>
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---

## Description

It generates bar plot that compares the effect size from eefAnalytics' methods.

## Usage

```
ComparePlot(
  eefAnalyticsList,
  group,
  Conditional = TRUE,
  ES_Total = TRUE,
  modelNames
)
```

**Arguments**

eefAnalyticsList	A list of eefAnalytics S3 objects from eefAnalytics package.
group	a string/scalar value indicating which intervention to plot. This must be one of the values of intervention variable excluding the control group. For a two arm trial, the maximum number of values to consider is 1 and 2 for three arm trial.
Conditional	a logical value to indicate whether to plot conditional effect size. The default is Conditional=TRUE, otherwise Conditional=FALSE should be specified for plot based on unconditional effect size. Conditional variance is total or residual variance a multilevel model with fixed effects, whilst unconditional variance is total variance or residual variance from a multilevel model with only intercept as fixed effect.
ES_Total	A logical value indicating whether to plot the effect size based on total variance or within school variance. The default is ES_Total=TRUE, to plot effect size using total variance. ES_Total=FALSE should be specified for effect size based on within school or residuals variance.
modelNames	a string factor containing the names of model to compare. See examples below.

**Details**

ComparePlot produces a bar plot which compares the effect sizes and the associated confidence intervals from the different models. For a multilevel model, it shows the effect size based on residual variance and total variance.

**Value**

Returns a bar plot to compare the different methods. The returned figure can be further modified as any [ggplot](#)

**Examples**

```
if(interactive()){

data(mstData)
#####
##### SRT #####
#####

outputSRT <- srtFREQ(Posttest~ Intervention + Prettest,
                    intervention = "Intervention", data = mstData)

outputSRTBoot <- srtFREQ(Posttest~ Intervention + Prettest,
                       intervention = "Intervention",nBoot=1000, data = mstData)

#####
##### MST #####
#####

outputMST <- mstFREQ(Posttest~ Intervention + Prettest,
```

```

random = "School", intervention = "Intervention", data = mstData)

outputMSTBoot <- mstFREQ(Posttest~ Intervention + Prettest,
                        random = "School", intervention = "Intervention",
                        nBoot = 1000, data = mstData)

#####
#### Bayesian ####
#####

outputSRTbayes <- srtBayes(Posttest~ Intervention + Prettest,
                           intervention = "Intervention",
                           nsim = 2000, data = mstData)

## comparing different results

ComparePlot(list(outputSRT,outputSRTBoot,outputMST,outputMSTBoot,outputSRTbayes),
            modelNames =c("ols", "olsBoot","MLM","MLMBoot","OLSBayes"),group=1)

}

```

---

crtBayes

*Bayesian analysis of Cluster Randomised Education Trials (CRT) using Vague Priors.*

---

## Description

crtBayes performs Bayesian multilevel analysis of cluster randomised education trials, utilising vague priors and JAGS language to fit the model. It assumes hierarchical clustering, such as students within schools, and estimates treatment effects while accounting for this structure.

## Usage

```
crtBayes(formula, random, intervention, nsim = 10000, data)
```

## Arguments

formula	The model to be analysed. It should be of the form $y \sim x_1 + x_2 + \dots$ , where $y$ is the outcome variable and $X$ s are the predictors.
random	A string specifying the "clustering variable" (e.g., schools or sites) as found in the dataset.
intervention	A string specifying the "intervention variable" as it appears in the formula.
nsim	Number of MCMC iterations to be performed. A minimum of 10,000 is recommended to ensure convergence.
data	A data frame containing the variables referenced in the formula, including predictors, the clustering variable, and the intervention.

## Details

The function provides posterior estimates for fixed effects (predictors) and random effects (clustering) under a Bayesian framework. Effect sizes are computed using Hedges'  $g$ , and variance components are decomposed into between-cluster and within-cluster variances.

## Value

S3 object; a list consisting of:

- **Beta**: Estimates and credible intervals for the predictors specified in the model (posterior distributions).
- **ES**: Hedges'  $g$  effect size for the intervention(s). If bootstrapping is not used, 95% credible intervals are computed based on MCMC sampling.
- **covParm**: Variance components broken down into between-cluster variance (e.g., between schools), within-cluster variance (e.g., within pupils), and intra-cluster correlation (ICC)..
- **ProbES**: A matrix showing the probability of observing an effect size larger than various thresholds (0, 0.05, 0.10, ...).
- **Unconditional**: A list containing the unconditional effect size and variance decomposition.

## Examples

```
if(interactive()){

  data(crtData)

  #####
  ## Bayesian analysis of cluster randomised trials  ##
  #####

  output <- crtBayes(formula = Posttest ~ Prettest + Intervention,
                     random = "School",
                     intervention = "Intervention",
                     nsim = 10000,
                     data = crtData)

  output

  ### Fixed effects
  beta <- output$Beta
  beta

  ### Effect size
  ES1 <- output$ES
  ES1

  ## Covariance matrix
  covParm <- output$covParm
  covParm

  ## Prob ES
  ProbES <- output$ProbES
```

```

ProbES

## Unconditional
Unconditional <- output$Unconditional
Unconditional

### plot random effects for schools

plot(output)

### plot posterior probability of an effect size to be bigger than a pre-specified threshold

plot(output,group=1)

#####
## Bayesian analysis of cluster randomised trials using informative priors for treatment ##
#####

### define priors for explanatory variables

my_prior <- normal(location = c(0,6), scale = c(10,1))

### specify the priors for the conditional model only

output2 <- crtBayes(Posttest~ Prettest+Intervention,random="School",
                    intervention="Intervention",nsim=2000,data=crtData,
                    condopt=list(prior=my_prior))

### Fixed effects
beta2 <- output2$Beta
beta2

### Effect size
ES2 <- output2$ES
ES2
}

```

---

crtData

*Cluster Randomised Trial Data.*


---

### Description

A cluster randomised trial dataset containing 22 schools. The data contains a random sample of test data of pupils and not actual trial data.

### Format

A data frame with 265 rows and 5 variables

**Details**

- Posttest: posttest scores
- Prettest: prettest scores
- Intervention: the indicator for intervention groups in a two arm trial, coded as 1 for intervention group and 0 for control group.
- Intervention2: a simulated indicator for intervention groups in a three arm trial.
- School: numeric school identifier

---

crtFREQ	<i>Analysis of Cluster Randomised Education Trials using Multilevel Model under a Frequentist Setting.</i>
---------	--

---

**Description**

crtFREQ performs analysis of cluster randomised education trials using a multilevel model under a frequentist setting.

**Usage**

```
crtFREQ(
  formula,
  random,
  intervention,
  baseIn,
  nPerm,
  nBoot,
  type,
  ci,
  seed,
  data
)
```

**Arguments**

formula	the model to be analysed is of the form $y \sim x_1+x_2+\dots$ . Where $y$ is the outcome variable and $X_s$ are the independent variables.
random	a string variable specifying the "clustering variable" as contained in the data. See example below.
intervention	a string variable specifying the "intervention variable" as appearing in the formula and the data. See example below.
baseIn	A string variable allowing the user to specify the reference category for intervention variable. When not specified, the first level will be used as a reference.
nPerm	number of permutations required to generate a permuted p-value.
nBoot	number of bootstraps required to generate bootstrap confidence intervals.

type	method of bootstrapping including case re-sampling at student level "case(1)", case re-sampling at school level "case(2)", case re-sampling at both levels "case(1,2)" and residual bootstrapping using "residual". If not provided, default will be case re-sampling at student level.
ci	method for bootstrap confidence interval calculations; options are the Basic (Hall's) confidence interval "basic" or the simple percentile confidence interval "percentile". If not provided default will be percentile.
seed	seed required for bootstrapping and permutation procedure, if not provided default seed will be used.
data	data frame containing the data to be analysed.

### Value

S3 object; a list consisting of

- Beta: Estimates and confidence intervals for variables specified in the model.
- ES: Conditional Hedges' g effect size and its 95% confidence intervals. If nBoot is not specified, 95% confidence intervals are based on standard errors. If nBoot is specified, they are non-parametric bootstrapped confidence intervals.
- covParm: A vector of variance decomposition into between cluster variance (Schools) and within cluster variance (Pupils). It also contains intra-cluster correlation (ICC).
- SchEffects: A vector of the estimated deviation of each school from the intercept.
- Perm: A "nPerm x 2w" matrix containing permuted effect sizes using residual variance and total variance. "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is produced only when nPerm is specified.
- Bootstrap: A "nBoot x 2w" matrix containing the bootstrapped effect sizes using residual variance (Within) and total variance (Total). "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is only produced when nBoot is specified.
- Unconditional: A list of unconditional effect sizes, covParm, Perm and Bootstrap obtained based on variances from the unconditional model (model with only the intercept as a fixed effect).

### Examples

```
if(interactive()){

data(crtData)

#####
## MLM analysis of cluster randomised trials + 1.96SE ##
#####

output1 <- crtFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",data=crtData)

### Fixed effects
```



```

beta <- output1$Beta
beta

### Effect size
ES1 <- output1$ES
ES1

## Covariance matrix
covParm <- output1$covParm
covParm

### plot random effects for schools

plot(output1)

#####
## MLM analysis of cluster randomised trials ##
## with residual bootstrap confidence intervals ##
#####

output2 <- crtFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",nBoot=1000,type="residual",data=crtData)

### Effect size

ES2 <- output2$ES
ES2

### plot bootstrapped values

plot(output2, group=1)

#####
## MLM analysis of cluster randomised trials with permutation p-value##
#####

output3 <- crtFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",nPerm=1000,data=crtData)

### Effect size

ES3 <- output3$ES
ES3

### plot permuted values

plot(output3, group=1)
}

```

GainIndex

*Calculate the Gain Index (GI) using JAGS***Description**

This function computes the Gain Index and other related statistics for educational trials. Gain index provides a proportion of pupils who would not have make good progress without intervention. This function supports flexible configurations for JAGS modeling.

**Usage**

```
GainIndex(
  data,
  formula,
  random,
  intervention,
  NA.omit = TRUE,
  n.iter = 20000,
  n.chains = 3,
  n.burnin = 10000,
  inits = NULL,
  model.file = NULL,
  alpha = 0.05
)
```

**Arguments**

data	A list containing the data for the JAGS model which must include columns: School, Posttest, Pretest, Intervention. Data should not have any missing values in these columns.
formula	the model to be analysed is of the form $y \sim x_1 + x_2 + \dots$ . Where $y$ is the outcome variable and $X_s$ are the independent variables. Formula does not need to include Intervention variable.
random	a string variable specifying the "clustering variable" as contained in the data. See example below.
intervention	a string variable specifying the "intervention variable" as appearing in the formula and the data. See example below.
NA.omit	Optional; a logic to check if omitting missing value. If NA.omit = TRUE, results will output the percentage of missing value in the four required columns and then JAGS results. If NA.omit = FALSE, will give a warning "Please handle missing values before using GainIndex()." If not provided, the function uses default TRUE.
n.iter	Total number of iterations for the MCMC simulation.
n.chains	Number of chains to run in the MCMC simulation.
n.burnin	Number of burn-in iterations to be discarded before analysis.

inits	Optional; a list of initial values for the JAGS model. If NULL, the function generates default initial values.
model.file	Optional; a custom path to the JAGS model file. If not provided, the function uses default path.
alpha	significant level, default alpha = 0.05.

### Value

An S3 object containing the following components:

**GI** A data frame containing the Gain Index and its 95% confidence intervals, as well as the Progress Index and its 95% confidence intervals.

**Proportions** A data frame showing the proportion of participants achieving each level of gain (low and high) for both control and intervention groups.

**Timing** A vector with execution time details, including user and elapsed time in seconds.

### Examples

```
##### EXAMPLE ONE: crtData #####
## Not run:
  data(crtData)
  output1 <- GainIndex(data = crtData, formula = Posttest~Prettest, random = "School", n.iter = 200,
                       intervention = "Intervention", NA.omit = T, alpha = 0.05)
  output1

##### EXAMPLE TWO: mstData #####
  data(mstData)
  output1 <- GainIndex(data = mstData, formula = Posttest~Prettest, random = "School", n.iter = 200,
                       intervention = "Intervention", NA.omit = T, alpha = 0.05)
  output1

## End(Not run)
```

---

mstBayes	<i>Bayesian analysis of Multisite Randomised Education Trials (MST) using Vague Priors.</i>
----------	---

---

### Description

mstBayes performs Bayesian multilevel analysis of multisite randomised education trials, utilising vague priors and JAGS language to fit the model. It assumes hierarchical clustering, such as students within schools, and estimates treatment effects while accounting for this structure.

### Usage

```
mstBayes(formula, random, intervention, nsim, data)
```

**Arguments**

formula	The model to be analysed. It should be of the form $y \sim x_1 + x_2 + \dots$ , where $y$ is the outcome variable and $X$ s are the predictors.
random	A string specifying the "clustering variable" (e.g., schools or sites) as found in the dataset.
intervention	A string specifying the "intervention variable" as it appears in the formula.
nsim	Number of MCMC iterations to be performed. A minimum of 10,000 is recommended to ensure convergence.
data	A data frame containing the variables referenced in the formula, including predictors, the clustering variable, and the intervention.

**Details**

The function provides posterior estimates for fixed effects (predictors) and random effects (clustering) under a Bayesian framework. Effect sizes are computed using Hedges'  $g$ , and variance components are decomposed into between-cluster and within-cluster variances.

**Value**

S3 object; a list consisting of:

- Beta: Estimates and credible intervals for the predictors specified in the model (posterior distributions).
- ES: Hedges'  $g$  effect size for the intervention(s). If bootstrapping is not used, 95% credible intervals are computed based on MCMC sampling.
- covParm: Variance components broken down into between-cluster variance (e.g., between schools), within-cluster variance (e.g., within pupils), and intra-cluster correlation (ICC)..
- randomEffects: Posterior estimates of random intercepts for each cluster (e.g., schools).
- ProbES: A matrix showing the probability of observing an effect size larger than various thresholds (0, 0.05, 0.10, ...).
- Unconditional: A list containing the unconditional effect size and variance decomposition.

**Examples**

```
if(interactive()){
  data(mstData)

  #####
  ## Bayesian analysis of multisite randomised trials  ##
  #####

  output <- mstBayes(formula = Posttest ~ Prettest + Intervention,
                     random = "School",
                     intervention = "Intervention",
                     nsim = 10000,
                     data = mstData)
```

```

output

### Fixed effects
beta <- output$Beta
beta

### Effect size
ES1 <- output$ES
ES1

## Covariance matrix
covParm <- output$covParm
covParm

## Prob ES
ProbES <- output$ProbES
ProbES

## Unconditional
Unconditional <- output$Unconditional
Unconditional

## Random Effect
randomEffects <- output$SchEffects
randomEffects

### plot random effects for schools

plot(output)

### plot posterior probability of an effect size to be bigger than a pre-specified threshold

plot(output,group=1)

#####
## Bayesian analysis of multisite randomised trials using informative priors for treatment ##
#####

### define priors for explanatory variables

my_prior <- normal(location = c(0,6), scale = c(10,1))

### specify the priors for the conditional model only

output2 <- mstBayes(Posttest~ Prettest+Intervention,random="School",
                    intervention="Intervention",nsim=2000,data=mstData,
                    condopt=list(prior=my_prior))

### Fixed effects
beta2 <- output2$Beta
beta2

```

```

### Effect size
ES2 <- output2$ES
ES2
}

```

---

mstData

*Multisite Trial Data.*


---

### Description

A multisite trial dataset containing 54 schools. This data contains a random sample of test data of pupils and not actual trial data.

### Format

A data frame with 210 rows and 5 variables

### Details

- Posttest: posttest scores
- Prettest: prettest scores
- Intervention: the indicator for the intervention groups in a two arm trial, coded as 1 for intervention group and 0 for control group.
- Intervention2: a simulated indicator for intervention groups in a three arm trial.
- School: numeric school identifier

---

mstFREQ

*Analysis of Multisite Randomised Education Trials using Multilevel Model under a Frequentist Setting.*


---

### Description

mstFREQ performs analysis of multisite randomised education trials using a multilevel model under a frequentist setting.

### Usage

```

mstFREQ(
  formula,
  random,
  intervention,
  baseIn,
  nPerm,
  data,

```

```

    type,
    ci,
    seed,
    nBoot
  )

```

### Arguments

formula	the model to be analysed is of the form $y \sim x_1+x_2+\dots$ . Where $y$ is the outcome variable and $X$ s are the independent variables.
random	a string variable specifying the "clustering variable" as contained in the data. See example below.
intervention	a string variable specifying the "intervention variable" as appearing in the formula and the data. See example below.
baseIn	A string variable allowing the user to specify the reference category for intervention variable. When not specified, the first level will be used as a reference.
nPerm	number of permutations required to generate permuted p-value.
data	data frame containing the data to be analysed.
type	method of bootstrapping including case re-sampling at student level "case(1)", case re-sampling at school level "case(2)", case re-sampling at both levels "case(1,2)" and residual bootstrapping using "residual". If not provided, default will be case re-sampling at student level.
ci	method for bootstrap confidence interval calculations; options are the Basic (Hall's) confidence interval "basic" or the simple percentile confidence interval "percentile". If not provided default will be percentile.
seed	seed required for bootstrapping and permutation procedure, if not provided default seed will be used.
nBoot	number of bootstraps required to generate bootstrap confidence intervals.

### Value

S3 object; a list consisting of

- Beta: Estimates and confidence intervals for variables specified in the model.
- ES: Conditional Hedge's  $g$  effect size (ES) and its 95% confidence intervals. If nBoot is not specified, 95% confidence intervals are based on standard errors. If nBoot is specified, they are non-parametric bootstrapped confidence intervals.
- covParm: A list of variance decomposition into between cluster variance-covariance matrix (schools and school by intervention) and within cluster variance (Pupils). It also contains intra-cluster correlation (ICC).
- SchEffects: A vector of the estimated deviation of each school from the intercept and intervention slope.
- Perm: A "nPerm x 2w" matrix containing permuted effect sizes using residual variance and total variance. "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is produced only when nPerm is specified.

- **Bootstrap:** A "nBoot x 2w" matrix containing the bootstrapped effect sizes using residual variance (Within) and total variance (Total). "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is only produced when nBoot is specified.
- **Unconditional:** A list of unconditional effect sizes, covParm, Perm and Bootstrap obtained based on variances from the unconditional model (model with only the intercept as a fixed effect).

## Examples

```

if(interactive()){

data(mstData)

#####
## MLM analysis of multisite trials + 1.96SE ##
#####

output1 <- mstFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",data=mstData)

### Fixed effects
beta <- output1$Beta
beta

### Effect size
ES1 <- output1$ES
ES1

## Covariance matrix
covParm <- output1$covParm
covParm

### plot random effects for schools

plot(output1)

#####
## MLM analysis of multisite trials          ##
## with residual bootstrap confidence intervals ##
#####

output2 <- mstFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",nBoot=1000,type="residual",data=mstData)

tp <- output2$Bootstrap
### Effect size

ES2 <- output2$ES
ES2

```



```

### plot bootstrapped values

plot(output2, group=1)

#####
## MLM analysis of mutltisite trials with permutation p-value##
#####

output3 <- mstFREQ(Posttest~ Intervention+Prettest,random="School",
intervention="Intervention",nPerm=1000,data=mstData)

ES3 <- output3$ES
ES3

#### plot permuted values

plot(output3, group=1)
}

```

---

plot.eefAnalytics      *A plot method for an eefAnalytics S3 object obtained from the eefAnalytics package.*

---

## Description

Plots different figures based on output from eefAnalytics package.

## Usage

```

## S3 method for class 'eefAnalytics'
plot(x, group, Conditional = TRUE, ES_Total = TRUE, slope = FALSE, ...)

```

## Arguments

x	an output object from the eefAnalytics package.
group	a string/scalar value indicating which intervention to plot. This must be one of the values of intervention variable excluding the control group. For a two arm trial, the maximum number of values to consider is 1 and 2 for three arm trial.
Conditional	a logical value to indicate whether to plot the conditional effect size. The default is Conditional=TRUE, otherwise Conditional=FALSE should be specified for plot based on the unconditional effect size. Conditional variance is total or residual variance from a multilevel model with fixed effects, whilst unconditional variance is total variance or residual variance from a multilevel model with only intercept as fixed effect.
ES_Total	A logical value indicating whether to plot the effect size based on total variance or within school variance. The default is ES_Total=TRUE, to plot the effect size using total variance. ES_Total=FALSE should be specified for the effect size based on within school or residuals variance.

`slope` A logical value indicating whether to return the plot of random intercept (default is `slope=FALSE`). return other school-by-intervention interaction random slope (s) is `slope=TRUE`. This argument is suitable only for `mstBayes` and `mstFREQ` functions.

`...` arguments passed to `plot.default`

### Details

Plot produces a graphical visualisation depending on which model is fitted:

- For `srtFREQ()`, plot can only be used when `nBoot` or `nPerm` is specified to visualise the distribution of bootstrapped or permuted values.
- For `crtFREQ()` or `mstFREQ()`, plot shows the distribution of random intercepts when `group=NULL`. It produces histogram of permuted or bootstrapped values when `group` is specified and either `nBoot` or `nPerm` is also specified.

### Value

Returns relevant plots for each model.

### Examples

```
if(interactive()){

#### read data
data(mstData)
data(crtData)

#####
##### SRT #####
#####

##### Bootstrapped

outputSRTBoot <- srtFREQ(Posttest~ Intervention + Prettest,
                        intervention = "Intervention",nBoot=1000, data = mstData)
plot(outputSRTBoot,group=1)

##### Permutation
outputSRTPerm <- srtFREQ(Posttest~ Intervention + Prettest,
                        intervention = "Intervention",nPerm=1000, data = mstData)

plot(outputSRTPerm,group=1)

#####
##### MST #####
#####
```

```

#### Random intercepts
outputMST <- mstFREQ(Posttest~ Intervention + Prettest,
                    random = "School", intervention = "Intervention", data = mstData)
plot(outputMST)

#### Bootstrapped
outputMSTBoot <- mstFREQ(Posttest~ Intervention + Prettest,
                        random = "School", intervention = "Intervention",
                        nBoot = 1000, data = mstData)

plot(outputMSTBoot)
plot(outputMSTBoot,group=1)

#### Permutation
outputMSTPerm <- mstFREQ(Posttest~ Intervention + Prettest,
                        random = "School", intervention = "Intervention",
                        nPerm = 1000, data = mstData)

plot(outputMSTPerm)
plot(outputMSTPerm,group=1)

#####
#### CRT #####
#####

#### Random intercepts
outputCRT <- crtFREQ(Posttest~ Intervention + Prettest, random = "School",
                    intervention = "Intervention", data = crtData)
plot(outputCRT)

## Bootstrapped
outputCRTBoot <- crtFREQ(Posttest~ Intervention + Prettest, random = "School",
                        intervention = "Intervention", nBoot = 1000, data = crtData)

plot(outputCRTBoot,group=1)

##Permutation
outputCRTPerm <- crtFREQ(Posttest~ Intervention + Prettest, random = "School",
                        intervention = "Intervention", nPerm = 1000, data = crtData)

plot(outputCRTPerm,group=1)
}

```

**Description**

Print for a fitted model represented by an eefAnalytics object.

**Usage**

```
## S3 method for class 'eefAnalytics'
print(x, ...)
```

**Arguments**

x                    Object of class eefAnalytics  
 ...                  Additional arguments of `print`

**Value**

Print conditional and unconditional effect sizes.

---

srtBayes

*Bayesian Analysis of Simple Randomised Education Trials (SRT) using Bayesian Linear Regression Model with Vague Priors.*

---

**Description**

srtBayes performs Bayesian multilevel analysis of Simple Randomised Education Trials (SRT), utilising vague priors and JAGS language to fit the model. This can also be used with schools as fixed effects.

**Usage**

```
srtBayes(formula, intervention, nsim = 10000, data)
```

**Arguments**

formula            The model to be analysed is of the form  $y \sim x_1 + x_2 + \dots$ . Where  $y$  is the outcome variable and  $X_s$  are the independent variables.

intervention      A string variable specifying the "intervention variable" as appearing in the formula and the data. See example below.

nsim                number of MCMC iterations per chain. Default is 2000.

data                Data frame containing the data to be analysed.

**Value**

S3 object; a list consisting of

- Beta: Estimates and credible intervals for the variables specified in the model. Use `summary.eefAnalytics` to get `Rhat` and effective sample size for each estimate.
- ES: Conditional Hedges'  $g$  effect size and its 95% credible intervals.
- sigma: Residual variance.
- ProbES: A matrix of Bayesian posterior probabilities such that the observed effect size is greater than or equal to a pre-specified threshold(s).
- Unconditional: A list of unconditional effect sizes, `sigma2` and ProbES obtained based on residual variance from the unconditional model (model with only the intercept as a fixed effect).

**Examples**

```

if(interactive()){

data(mstData)

#####
## Bayesian analysis of simple randomised trials      ##
#####

output <- srtBayes(Posttest~ Intervention+Prettest,
intervention="Intervention",nsim=10000,data=mstData)

### Fixed effects
beta <- output$Beta
beta

### Effect size
ES1 <- output$ES
ES1

## Covariance matrix
covParm <- output$covParm
covParm

### plot random effects for schools

plot(output)

### plot posterior probability of an effect size to be bigger than a pre-specified threshold

plot(output,group=1)

#####
## Bayesian analysis of simple randomised trials using informative priors for treatment ##
#####

```

```

### define priors for explanatory variables

my_prior <- normal(location = c(0,6), scale = c(10,1))

### specify the priors for the conditional model only

output2 <- srtBayes(Posttest~ Prettest+Intervention,
                    intervention="Intervention",
                    nsim=2000,data=mstData,
                    condopt=list(prior=my_prior))

### Fixed effects
beta2 <- output2$Beta
beta2

### Effect size
ES2 <- output2$ES
ES2
}

```

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srtFREQ

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*Analysis of Simple Randomised Education Trial using Linear Regression Model.*


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## Description

srtFREQ performs analysis of educational trials under the assumption of independent errors among pupils. This can also be used with schools as fixed effects.

## Usage

```
srtFREQ(formula, intervention, baseIn, nBoot, nPerm, ci, seed, data)
```

## Arguments

formula	the model to be analysed is of the form $y \sim x_1 + x_2 + \dots$ . Where $y$ is the outcome variable and $X_s$ are the independent variables.
intervention	a string variable specifying the "intervention variable" as appearing in the formula and the data. See example below.
baseIn	A string variable allowing the user to specify the reference category for intervention variable. When not specified, the first level will be used as a reference.
nBoot	number of bootstraps required to generate bootstrap confidence intervals.
nPerm	number of permutations required to generate permuted p-value.
ci	method for bootstrap confidence interval calculations; options are the Basic (Hall's) confidence interval "basic" or the simple percentile confidence interval "percentile". If not provided default will be percentile.
seed	seed required for bootstrapping and permutation procedure, if not provided default seed will be used.
data	data frame containing the data to be analysed.

**Value**

S3 object; a list consisting of

- Beta: Estimates and confidence intervals for the variables specified in the model.
- ES: Conditional Hedges'g effect size and its 95% confidence intervals. If nBoot is not specified, 95% confidence intervals are based on standard errors. If nBoot is specified, they are non-parametric bootstrapped confidence intervals.
- sigma2: Residual variance.
- Perm: A "nPerm x w" matrix containing permuted effect sizes using residual variance. "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is produced only if nPerm is specified.
- Bootstrap: A "nBoot x w" matrix containing the bootstrapped effect sizes using residual variance. "w" denotes number of intervention. "w=1" for two arm trial and "w=2" for three arm trial excluding the control group. It is produced only if nBoot is specified.
- Unconditional: A list of unconditional effect size, sigma2, Perm and Bootstrap obtained based on variances from the unconditional model (model with only intercept as fixed effect).

**Examples**

```
if(interactive()){

data(mstData)

#####
## Analysis of simple randomised trials using Hedges Effect Size ##
#####

output1 <- srtFREQ(Posttest~ Intervention+Prettest,
intervention="Intervention",data=mstData )
ES1 <- output1$ES
ES1

#####
## Analysis of simple randomised trials using Hedges Effect Size ##
## with Permutation p-value ##
#####

output2 <- srtFREQ(Posttest~ Intervention+Prettest,
intervention="Intervention",nPerm=1000,data=mstData )

ES2 <- output2$ES
ES2

#### plot permuted values

plot(output2, group=1)
```

```
#####
## Analysis of simple randomised trials using Hedges Effect Size ##
## with non-parametric Basic bootstrap confidence intervals      ##
#####

output3 <- srtFREQ(Posttest~ Intervention+Prettest,
intervention="Intervention",nBoot=1000,ci="basic",data=mstData)

ES3 <- output3$ES
ES3

### plot bootstrapped values

plot(output3, group=1)

#####
## Analysis of simple randomised trials using Hedges' effect size ##
## with schools as fixed effects                                ##
#####

output4 <- srtFREQ(Posttest~ Intervention+Prettest+as.factor(School),
intervention="Intervention",data=mstData )

ES4 <- output4$ES
ES4

#####
## Analysis of simple randomised trials using Hedges' effect size ##
## with schools as fixed effects and with permutation p-value    ##
#####

output5 <- srtFREQ(Posttest~ Intervention+Prettest+as.factor(School),
intervention="Intervention",nPerm=1000,data=mstData )

ES5 <- output5$ES
ES5

### plot permuted values

plot(output5, group=1)

#####
## Analysis of simple randomised trials using Hedges' effect size ##
## with schools as fixed effects and with permutation p-value    ##
#####

output6 <- srtFREQ(Posttest~ Intervention+Prettest+as.factor(School),
intervention="Intervention",nBoot=1000,data=mstData)

ES6 <- output6$ES
ES6

### plot bootstrapped values
```



```
plot(output6, group=1)
}
```

---

summary.eefAnalytics *Summary for a fitted model represented by an eefAnalytics object.*

---

### Description

Summary for a fitted model represented by an eefAnalytics object.

### Usage

```
## S3 method for class 'eefAnalytics'
summary(object, ...)
```

### Arguments

object	Object of class eefAnalytics
...	Additional arguments of <a href="#">summary</a>

### Value

Returns relevant summary including Rhat and effective sample sizes.

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