Evidence-based SMarty Support for Variability Identification and Representation in Component Models

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Keywords: Component, Effectiveness, Empirical Evaluation, Product-line Architecture, SMarty, Software Product Line, UML, Variability Management.

Abstract: Variability modeling is an essential activity for the success of software product lines. Although existing literature presents several variability management approaches, there is no empirical evidence of their effectiveness for representing variability at component level. SMarty is an UML-based variability management approach that currently supports use case, class, activity, sequence and component models. SMarty 5.1 provides a fully compliant UML profile (SMartyProfile) with stereotypes and tagged-values and a process (SMartyProcess) with a set of guidelines on how to apply such stereotypes towards identifying and representing variabilities. At component level, SMarty 5.1 provides only one stereotype, ≪variable≫, which means that any classes of a given component have variability. Such a stereotype is clearly not enough to represent the extent of variability modeling in components, ports, interfaces and operations. Therefore, this paper presents how the improved version (5.2) of SMarty can identify and represent variability on such component-related elements, as well as an experimental study that provides evidence of the SMarty effectiveness.

1 INTRODUCTION

The Software Product Line (SPL) technique aims at realizing the generation of specific products based on the reuse of a central infrastructure, the core assets, which consists of a software architecture and respective components (Linden et al., 2007) (Pohl et al., 2005).

The SPL Architecture (SPLA) is the main artifact of an SPL. It represents an abstraction of all possible products that can be generated (Linden et al., 2007) (OliveiraJr et al., 2013). Important SPLA requirements include: (i) remain stable during the SPL lifetime; (ii) easy integration of new features during the architecture life cycle; and (iii) explicit representation of variability for providing reuse.

Variability is a term used to represent parts of specific SPL products that differ one another (Pohl et al., 2005). The amount of differences or dependencies between SPL products is directly reflected in the complexity of its architecture (Jazayeri et al., 2000). The SPL architecture (SPLA) should encompass artifacts that perform similar and variable features in a specific domain (OliveiraJr et al., 2013).

There are several variability management approaches in the literature, most of them supporting UML models (Capilla et al., 2013; Galster et al., 2014). The representation of variability in UML models is performed by means of stereotypes. UML-based approaches that support variability at component level do not support the representation of most of the variability aspects in architectural elements. In addition, they do not provide empirical evidence of their effectiveness.

Stereotype-based Management of Variability (SMarty) (OliveiraJr et al., 2010) is an approach that allows the identification and representation of variabilities in UML models, including use case, class, activity, sequence and component elements. However, SMarty version 5.1 (Marcolino et al., 2014b) supports component models with only one stereotype: ≪variable≫. It means that a given component has some sort of variability in its classes. Given the importance of the SPLA for the success of a SPL, it is clear that only one stereotype is not enough to explicitlly represent all variability aspects of a SPLA.

This paper presents an improved version of SMarty, the version 5.2, for allowing the representation of variabilities at component level towards a more accurate support for SPLA. SMarty 5.2 uses many *SMartyProfile* stereotypes to represent variability in

Bera M., Oliveira Jr. E. and Colanzi T..
Evidence-based SMarty Support for Variability Identification and Representation in Component Models.
DOI: 10.5220/0005366402950302
In *Proceedings of the 17th International Conference on Enterprise Information Systems* (ICEIS-2015), pages 295-302
ISBN: 978-989-758-097-0

the SPLA logical view including components, ports, interfaces and operations. In addition, SMarty 5.2 defines guidelines that provide stakeholders directions on how to identify and represent variability in component elements throughout SMarty stereotypes. Besides the improved version of SMarty, this paper also presents an experimental study carried out to provide empirical evidence of the SMarty 5.2 effectiveness. Amongst the related approaches identified in the literature, the Razavian and Khosravi's approach (Razavian and Khosravi, 2008) was considered for the performed study, as discussed in Section 2.

Next sections of this paper are organized as follows: Section 2 presents essential background and related work; Section 3 addresses the SMarty 5.2 approach for identifying and representing variability in component models; Section 4 presents the planning, execution and analysis and interpretation of the experimental study carried out; and Section 5 presents conclusion and directions for future works.

2 BACKGROUND AND RELATED WORK

UML version 2.5 was released in late 2013, with the aim of reducing redundancy in several elements. Although there is no changes to the language, the UML 2.5 provides simplicity of main aspects of component models. For instance, compartments of a black-box component notation allow the application of stereotypes to represent variability, whereas ports do not.

Component elements, such as ports and operations, can be represented in respective compartments and tagged with stereotypes. However, stereotypes in interfaces are not explicitly visible. Thus, by means of a further exploration of component compartments, the representation of variability becomes more intuitive.

Variability is a key-issue for the success of a SPL (Capilla et al., 2013; Galster et al., 2014). Variability management is one of the most important SPL management activities as it provides core assets to represent how SPL members can differ one another (Linden et al., 2007; Pohl et al., 2005). Variability is a key-issue for the success of a SPL (Capilla et al., 2013; Galster et al., 2014). Variability management is one of the most important SPL management activities as it provides core assets to represent how SPL members can differ one another (Linden et al., 2007; Pohl et al., 2005).

Variability is represented by variation points, which are where variations take place, and variants, which represent possible elements to resolve a variation point. Thus, one or more variants should be selected taking into consideration possible constraints that define relationships between them (Linden et al., 2007).

The existing literature presents several variability management approaches, such as, feature-oriented and UML-based (Capilla et al., 2013). Managing variabilities based on UML means identifying, representing and tracing variability throughout UML models, such as use case, class and component.

There are several different variability management approaches for component models as presented in Table 1, related to this work.

Each study from Table 1 (Column *Id.*) is briefly presented as follows:

- **S1:** represents variability using stereotypes for UML 2.0 components and connectors with no traceability. It provides four stereotypes as an extension of the UML metamodel: ≪variation point≫, ≪variant≫, ≪optional≫, ≪optional component≫;
- **S2:** represents variability using stereotypes for components and packages with no traceability. It provides the following stereotypes based on the Variability Viewpoint technique: ≪Alternative≫ and ≪Optional≫;
- **S3:** represents variability in components and connectors based on the Component & Connector (C&C) View and Formal Concept Analysis (FCA) allowing tracing;
- **S4:** represents variability in components, connectors and interfaces with no traceability. It provides the following UML 2.0 stereotypes: ≪alt_vp≫, ≪opt_vp≫, ≪optional≫, ≪optv_vp≫, ≪altv_vp≫, and ≪variant≫;
- **S5:** represents variability in components with no traceability. It provides the following UML 2.0 stereotypes: ≪kernel≫, ≪variant≫, and ≪optional≫;
- **S6:** represents variability in components using PLUS and Orthogonal Variability Model (OVM) technique with no traceability. It provides the stereotypes ≪kernel≫ and ≪optional≫ from PLUS. From OVM, graphical models indicate a variation point and associated variant components.

Based on such a description, the Razavian and Khosravi approach (Razavian and Khosravi, 2008) (Study S4) is further presented as it is similar to SMarty (Section 3) at providing an extension of the UML metamodel as stereotypes and tagged values for at least components and interfaces. Studies S1 and S5

Table 1: Related Work: Variability Management Approaches for Components Models.

Id.	Study Ref.	Tools of Study	UML Support	UML Version	Architecture-related Elements	Traceability
[S1]	(Choi et al., 2005)	Extension of UML 2.0	Yes	2.0	Components and Connectors.	No
[S2]	(Tekinerdogan and Sözer, 2012)	*Variability Viewpoint*	No	–	Components and Packages.	No
[S3]	(Satyananda et al., 2007)	*C&C View* + FCA	No	–	Components and Connectors.	Yes
[S4]	(Razavian and Khosravi, 2008)	*C&C View*	Yes	2.0	Components, Connectors and Interfaces.	No
[S5]	(Gomaa, 2013)	PLUS	Yes	2.0	Components.	No
[S6]	(Ryu et al., 2012)	PLUS + OVM	No	2.0	Components.	No

do not support UML ports, interfaces and operations. S1 supports connectors, but they are not standardized in UML. Studies S2, S3 and S6 do not (fully-)support UML.

Razavian and Khosravi propose one of the most relevant approaches for modeling variabilities in architectures using UML and the Component and Connector (C&C) view models (Ivers et al., 2004). Such an approach represents variability based on a UML 2.0 profile with guidelines on how to represent product architectures.

The stereotypes for representing variation points and variants in components, connectors and interfaces are as follows:

- ≪opt_vp≫: is the choice of zero or one variant from a set of variants;
- ≪alt_vp≫: is the choice of only one variants from a set of variants;
- ≪variant≫: a variant associated with a particular variation point;
- ≪optional≫: an optional variant;
- ≪altv_vp≫: is the choice of one or more variants from a set of variants;
- ≪optv_vp≫: is the choice of zero or more variants from a set of variants.

The Razavian and Khosravi approach uses elements to represent connectors, which are not considered by the standard UML. Thus, the C&C view (Ivers et al., 2004) by means of a rectangle classifier (UML class model) with the stereotype ≪connector≫ is used to represent connectors variation point, and one or more rectangles classifiers to represent possible variants.

Figure 1 presents an excerpt of the Virtual University SPLA representing variability according to Razavian and Khosravi. Connectors `High BW MS` and `Low BW MS` are mutually exclusive variants and the connector `Media Stream Protocol` is a variation point that has the variability. As a result, it is an alternative variation point. Note that the stereotype ≪connector≫ is used to represent a connector as UML has no such an element.

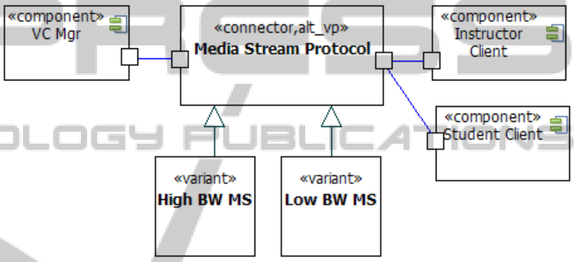

Figure 1: Virtual University SPL Architecture: Variability in Bandwidth (Razavian and Khosravi, 2008).

3 SMarty 5.2 FOR VARIABILITY IN COMPONENT MODELS

The **S**tereotype-based **M**anagement of **V**ariabili**ty** (SMarty) (OliveiraJr et al., 2010) is an approach focused on identifying and representing variabilities in SPL. It encompasses a UML profile, named *SMartyProfile*, which is a set of stereotypes and tagged values for representing variabilities, and a process, named *SMartyProcess*, which guides users to identify variability by means of a set of guidelines to apply stereotypes in SPL artifacts. SMarty version 5.1 (Marcolino et al., 2014b; Marcolino et al., 2013) supports use case, class, activity, sequence, and component models.

The SMarty 5.1 support for components is simply based on one stereotype, ≪variable≫, applied to a component, which means that a component is formed by classes that have incorporated variabilities. Such an information is insufficient for further representation of variabilities and deriving products from SPLAs. Thus, SMarty 5.1 was evolved to 5.2 towards representing variability according to the UML 2.5 component specification (OMG,

2014) with relation to the following component-based architecture-related elements: component, port, interface (`InterfaceRealization`), and interface operation (`Operation`). SMarty 5.2 stereotypes are, then, applied to such elements taking into consideration the following relationships: one component for *n* ports; one port for *n* interfaces; and one interface for *n* operations. Based on such relationships, several guidelines for component models were defined to apply the SMarty 5.2 stereotypes.

The defined guidelines of *SMartyProcess* for component models are:

- CP.1 Components consisting of classes and realizations with variability are tagged as ≪variable≫.
- CP.2 Interfaces related to a same concern might be inclusive variants tagged as ≪alternative_OR≫ and associated with a given port tagged as ≪variationPoint≫.
- CP.3 Optional interfaces (≪optional≫) should be associated directly to a component in order to avoid empty ports, except when a port is a variation point with *minSelection* $\geq$ *1*.
- CP.4 Ports and operations with variability representation must be in a classifier compartment format.
- CP.5 Interfaces with variabilities must be presented in the Classifier format.

Figure 2 presents an excerpt of the Mobile Media SPLA according to SMarty 5.2. Ports `pIMusic`, `pIVideo` and `pIPhoto` are inclusive variants related to the variation point component `MediaMgr`. Note that port `pIMedia` is mandatory for such a component.

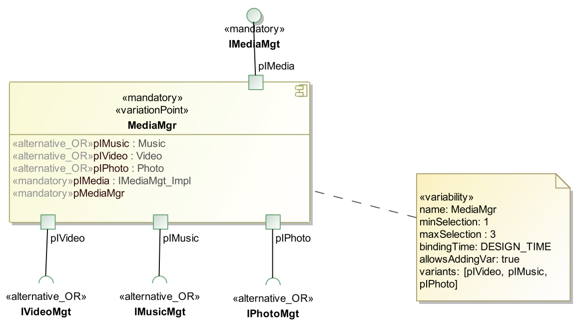

Figure 2: Mobile Media Excerpt According to SMarty 5.2: `MediaMgr` Variation Point Component and Respective Inclusive Variant Ports.

Figure 3 presents an excerpt of the Mobile Media SPLA according to SMarty 5.2. Interfaces `IPlayBowling`, `IPlayBrickles` and `IPlayPong` are inclusive variants related to the variation point port `pPlayGame`, according to guideline CP.2. A specific product derived from such an excerpt must have at least 1 (`minSelection` attribute) and at most 3 (`maxSelection` attribute) interfaces from such a port.

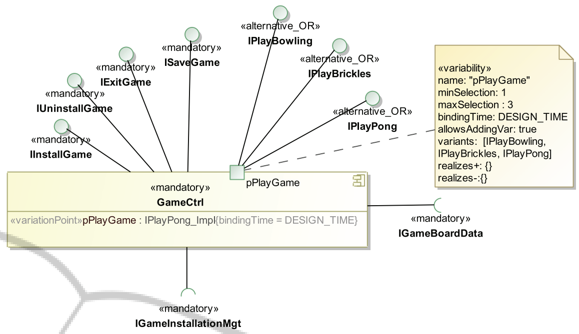

Figure 3: Mobile Media Excerpt According to SMarty 5.2: `pPlayGame` Variation Point Port and Respective Inclusive Variant Interfaces.

Figure 4 presents an excerpt of the Mobile Media SPLA according to SMarty 5.2. Operations `playVideo`, `playMusic` and `visualizePhoto` are inclusive variants related to the variation point interface `IPlayMedia`.

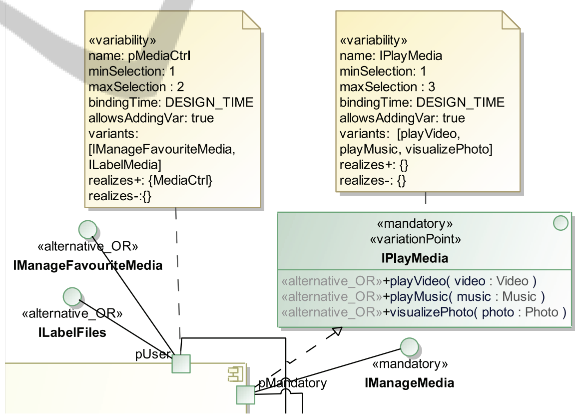

Figure 4: Mobile Media Excerpt According to SMarty 5.2: `IPlayMedia` Variation Point Interface and Respective Inclusive Variant Operations.

4 EFFECTIVENESS OF SMarty: EXPERIMENTAL STUDY

This section presents an experimental study in order to compare SMarty 5.2 and the Razavian and Khosravi approach with relation to their effectiveness in identifying and representing variability in component models. Table 2 summarizes the main features of such approaches. Note that in most criteria, SMarty and the Razavian and Khosravi approach are similar. Thus, such a similarity and its popularity[1] justify our choice for the Razavian and Khosravi approach.

Table 2: SMarty and Razavian and Khosravi Approaches Support for UML Component Models.

Criterion			Aproaches: SMarty 5.2 (Component Model)	Aproaches: Razavian and Khosravi (Razavian and Khosravi, 2008) (Component Model)
Support for UML Models			☑	☑
UML Profile Definition			☑	☑
Guidelines for Identification and Representation of Variability			☑	☑
UML Stereotypes			☑	☑
Explicit Representation of	Variation Point		☑	☑
	Variant	Optional	☑	☑
		Inclusive (OR)	☑	☒
		Exclusive (XOR)	☑	☑
	Variability		☑	☒
	Constraints Among Variants	Complement	☑	☒
		Mutually Exclusive	☑	☒
Cardinality			☑	☒
Binding Time declaration			☑	☒
Addtion of new Variants			☑	☒
Traceability			☑	☒

Legend: ☑ Supports the criterion ☒ Does not support the criterion

4.1 Experiment Definition

The goal of this experiment was to **compare** the Razavian and Khosravi and the SMarty approaches, **for the purpose of** identifying the most effective, **with respect to** the capability of identification and representation of variabilities in SPLA UML component models, **from the point of view of** SPL architects, **in the context of** master and Ph.D. students of the Software Engineering area from the State University of Maringá (UEM), University of São Paulo (ICMC-USP) and Pontifical Catholic University of Rio Grande do Sul (PUCRS).

It established the following research question (R.Q.): Which methodology is more effective at identifying and representing variabilities in SPLA UML component models: SMarty 5.2 or Razavian and Khosravi?

4.2 Experiment Planning

Training: subjects were trained with regard to essential concepts of SPL and variability and UML component models variability identification and representation using the Razavian and Khosravi or SMarty approaches.

Pilot Project: it was conducted with a lecturer, working for 25 years in the area of Software Engineering. She provided adjustments for improving the experiment instrumentation.

Selection of Subjects: the 14 selected subjects were master and Ph.D. students who have prior knowledge in UML modeling components. Furthermore, after training, each subject should be familiar with SPL variability essential concepts.

Instrumentation: each subject was given a set of documents, as follows:

- term of informed consent (TCLE - Brazilian standard for this type of experiment);
- a characterization questionnaire.This document was previously filled online, then used to separate subjects according to their prior knowledge to avoid any biases; and
- the description of Virtual University and Mobile Media SPLs and their component models with no variabilities.

Balancing: subjects were separated into two groups by their knowledge. One group focused on the X approach (Razavian and Khosravi) and one group focused on the Y approach (SMarty). One group was trained to identify and represent variabilities according to the X approach and the other group was trained to identify and represent variabilities according to the Y approach. Tasks were assigned in equal number to a similar number of subjects.

Hypotheses Formulation: the following hypotheses were tested in this study:

Null Hypothesis (H_0): both X and Y approaches are equally effective in terms of identifying and representing variabilities in UML component models.

Alternative Hypothesis (H_1): X approach is less effective than Y approach.

Alternative Hypothesis (H_2): X approach is more effective than Y approach.

Dependent Variable: `effectiveness` calculated for a given variability management approach (X and Y) as follows:

$$\textbf{\textit{effectiveness(z)}} = \begin{cases} nVarC, & \text{if } nVarI{=}0 \\ nVarC - nVarI, & \text{if } nVarI{>}0 \end{cases} \quad (1)$$

where:

- z is a variability management approach;
- $nVarC$ is the number of correct identified variability elements according to the z approach;
- $nVarI$ is the number of incorrect identified variability elements according to the z approach.

A variability element might be either a variation point or a variant. The effectiveness expression is inspired in several works, including SPL, as (Basili and

[1]The Razavian and Khosravi approach is cited in various works as indicated by Google Scholar at http://scholar.google.com/citations?user=hwtquZEAAAAJ&hl=en

Selby, 1987; Coteli, 2013; Martinez-Ruiz et al., 2011; Marcolino et al., 2014a; Marcolino et al., 2014b).

Independent Variables: `the variability management approach`, which is a factor with two treatments (X and Y) and `the SPL`, which is a factor with two treatments (Virtual University and Mobile Media). Virtual University was selected as Razavian and Khosravi provides explanations of their approach based on such an SPL, thus we understand that its selection is essential. Mobile Media is a well-known SPL, already consolidated in the SPL community.

Random Capacity: selection of the subjects was not random within the universe of the volunteers, which was quite restricted. The random capacity took place at the assignment of the variability management approach (X or Y) to each subject.

4.3 Execution

The main task for each subject was reading and understanding the Virtual University and Mobile Media SPLs description documents, randomly distributed. Then, subjects annotated variabilities in the SPL models.

Participation Procedure: the following procedures were performed for each subject participation:

0. subjects answer an online characterization questionnaire;

1. subject personally attended the location where the study took place;

2. experimenter gives subject a set of documents: (i) the experimental study consent term; (ii) document with essential concepts of variability management in SPL; (iii) document with essential concepts of UML 2.5; and (iv) the description of the Virtual University and Mobile Media SPLs.

3. experimenter randomly associates each subject to the X or Y approach;

4. experimenter trains the subjects on respective approach;

5. subject identifies and represents variabilities in the Virtual University and Mobile Media component models according to his/her associated approach.

Collected data is presented in Table 3 and analyzed using appropriate statistical methods, which are properly discussed in Section 4.4. For each subject (“`Subject #`” column), the following data for his/her given approach was collected: the number of correct and incorrect identified and represented variabilities; and the effectiveness calculation.

Correct/Incorrect Variability Rate Criteria: criteria was based on the variability of the Virtual University and Mobile Media SPLs. Each correct variability corresponds to 1 point. Each SPL has 11 variabilities, thus a maximum score of 11 points is possible. Therefore, subjects had to model two SPLs with a maximum score of 22 points.

Figure 5 presents X and Y approaches effectiveness boxplot.

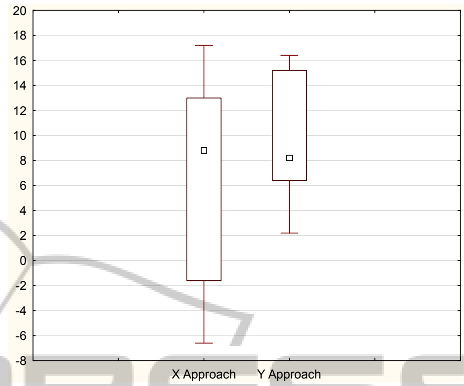

Figure 5: Effectiveness of X and Y Approaches.

4.4 Analysis and Interpretation

Based on the results obtained by analyzing the application of the X and Y approaches to the Virtual University and Mobile Media SPLs, we analyzed and interpreted the X and Y collected data (sample) by means of the Shapiro-Wilk normality test and the T Test for testing the defined hypotheses.

1. **Effectiveness Normality Tests:** Shapiro-Wilk test was applied to the Virtual University and Mobile Media samples (Table 3) providing the following results:
   - ***Effectiveness of X approach (N=7):*** with a mean value (μ) 6.4286, standard deviation value of (σ) 8.3118, the total effectiveness for X approach was p = 0.8725 for the *Shapiro-Wilk* test. Thus, for a significance level ($\alpha = 0.05$), p = 0.8725 ($0.8725 > 0.05$) and calculated value of $W = 0.9665 > W = 0.8030$, the sample is considered normal.
   - ***Effectiveness of Y Approach (N=7):*** with a mean (μ) 9.2571, standard deviation (σ) 5.0089, the total effectiveness for the Y approach was p = 0.5797 for the *Shapiro-Wilk* test. Thus, for a significance level ($\alpha = 0.05$), p = 0.5797 ($0.5797 > 0.05$) and calculated value $W = 0.9333 > W = 0.8030$, the sample is considered normal.
2. **Effectiveness Hypothesis Test:** T-test was applied for samples X and Y as they are independent.

Table 3: Virtual University and Mobile Media SPLs Collected Data and Descriptive Statistics for the X (Razavian and Khosravi) and Y (SMarty) Approaches.

The X Approach (Razavian and Khosravi)				*The Y Approach (SMarty 5.2)*			
Subject#	Correct Identified Variabilities	Incorrect Identified Variabilities	Effectiveness Calculation	Subject#	Correct Identified Variabilities	Incorrect Identified Variabilities	Effectiveness Calculation
1	15.90	6.10	9.80	**1**	18.60	3.40	15.20
2	10.20	11.80	-1.60	**2**	15.70	6.30	9.40
3	17.50	4.50	13.00	**3**	15.10	6.90	8.20
4	19.60	2.40	17.20	**4**	14.20	8.70	6.40
5	15.40	6.60	8.80	**5**	12.10	9.90	2.20
6	13.20	8.80	4.40	**6**	14.50	7.50	7.00
7	7.20	13.80	-6.60	**7**	19.20	2.80	16.40
Mean	**14.14**	**7.71**	**6.43**	Mean	**15.63**	**6.50**	**9.26**
Std. Dev.	**4.29**	**4.03**	**8.31**	Std. Dev.	**2.50**	**2.61**	**5.01**
Median	**15.40**	**6.60**	**8.80**	Median	**15.10**	**6.90**	**8.20**

First, the value of T was obtained, which allows the identification of the range entered in the statistical table T (*student*). This value is calculated using the average of Sample X ($\mu 1 = 6.4286$) and Sample Y ($\mu 2 = 9.2571$), standard deviation value of both ($\sigma 1 = 8.3118$ and $\sigma 2 = 5.0089$), and the sample sizes ($N = 7$). It was obtained the value $t_{calculated} = 0.7711$.

By taking the sample size ($N = 7$), we obtained the degree of freedom (df), which combined to the t value indicates which value of p in the T table must be selected. The p value is used to accept or reject the T-test null hypothesis (H_0).

By searching the index $df = 12$ and defining the value t at the T table (*student*), it was found a value for critical t of 2.179 ($t_{critical} = 2.179$), with a significance level (α) of 0.05. This means that the probability of $t_{calculated}$ (0.7711) $< t_{critical}$ (2.132) is 95%. Thus, the null hypothesis H_0 must be rejected.

Therefore, based on the result from the T-test, the null hypothesis (H_0) of this experimental study (Section 4.2) can be rejected. By analyzing Figure 5 it can be observed that the Y approach (SMarty Approach) is more effective than the X approach (Razavian and Khosravi Approach) for representing variability at SPL component level for this experimental study. Thus, H_1 can be accepted.

Based on this analysis, we can observe that SMarty 5.2 had a superior result corroborated by the fact that: (i) SMarty is more precise on modeling fine-grained variability detail, such as, min and max number of variants to be selected and the set of possible variant choices, whereas the Razavian and Khosravi approach has no such details; (ii) taking into account such details, SMarty has a major capability of deriving consistent specific products with no domain expert intervention; and (iii) with no domain expert intervention, the consistent specific products derivation process can be fully automated in SMarty, whereas deriving products from Razavian and Khosravi variability component models requires a prospective human-supervised stage as it provides insufficient information.

In a comparison between SMarty version 5.1 and the Razavian and Khosravi approach, the later would provide a huge effectiveness as SMarty 5.1 was incipient by only tagging a component as ≪variable≫ and providing no mechanism to derive specific products based on such a modeling. Thus, it corroborates that SMarty needed to evolve to version 5.2.

4.5 Validity Evaluation

Threats to Conclusion Validity. Sample size (N=14) was too small, thus it must be increased in prospective replications.

Threats to Construct Validity. Construction of the experiment was based on the characteristics of each SPL, and instrumentation evaluated during the pilot project.

Threats to Internal Validity. Subject knowledge was prior balanced, to perform the experiment tasks, based on the characterization questionnaire to avoid biases in random block division. Training and experiment sessions were performed in different days, with an average of 30 minutes each, thus fatigue was not considered relevant. Subjects were supervised by a human, thus they did not talk to each other before and during the experiment sessions.

Threats to External Validity. Component models of the SPLs are not commercial, thus further studies must consider real SPLs. Although masters and Ph.D. students were selected rather than practitioners from industry, they were not considered a bias to this study as the importance of using students in experimental studies (Höst et al., 2000).

5 CONCLUSION AND FUTURE WORK

This paper presented an improved version of the

SMarty approach to represent variability in UML components models, specifically at four levels: (i) components; (ii) ports; (iii) interfaces; and (iv) interface operations.

Furthermore, this paper also presented an experimental study performed with the goal of observing the effectiveness of SMarty. This experimental study was conducted based on the comparison of two approaches, SMarty 5.2 and Razavian and Kosravi, to represent variabilities in SPL components. The results provide evidence of the effectiveness of SMarty approach to model variability in UML components models, in the context of the performed study.

Given the promising results, new experimental studies and replications should be conducted. Such further studies should take into consideration some issues such as real SPLs; industry subjects in order to generalize the results expected; and the increase of the sample. Such considerations are important in order to corroborate the results of this experimental study.

ACKNOWLEDGEMENTS

The authors thank **CAPES-Brasil** for granting M. Bera a two-year masters degree scholarship.

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