

Proposal of an instrument for measuring situational motivation with potential applications in educational contexts

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Abstract—The study of the motivational aspect and its relevance to the comprehension of the efficacy of learning has been the subject matter of several researches. According to the Self-determination Theory (SDT) there is a relation between the context, the motivation, and the performance of individuals in a given task. Thus, a continuum is defined between intrinsic, extrinsic, and lack of motivation; so individuals intrinsically motivated would perform optimally. In order to adequate the communication module of the system Sapiens for the learning of efficient energy consumption, this work has proposed to develop an instrument to evaluate the level of situational motivation of individuals, and to design persuasive messages to increase the engagement on the task, based on the motivation profiles described by SDT. For this, a methodology was defined comprising the following stages: (i) bibliographic research of the state-of-art scales to assess motivation; (ii) design of a data collection instrument in the form of a structured questionnaire; (iii) evaluation of the instrument considering an heterogeneous sample of 589 college, high-school, technical, master, and doctoral students, aged between 14 and 80 years, at three different situations (the library, the classroom, and leisure); (iv) design of the persuasive messages to enhance the user engagement on the task. The resulting instrument was named Ubiquitous Situational Motivation Scale (USMS), consisted in 18 questions presented as a 7-points Likert Scale, that measures four motivational factors with Cronbach alpha coefficients ranging from 0.61 to 0.86. Our study revealed that subjects' motivation profile varied according to the context, so leisure activities were respectively more related to intrinsic motivation than the library and the classroom activities, and suggests that classroom activities are probably more related to external regulation. The results were also consistent with the continuum hypothesis of SDT. The evaluation with potential users showed that the persuasive messages designed based on the motivational profiles were positively rated. From these results the persuasive module will be integrated to the Sapiens platform so the performance of the users can be studied.

I. INTRODUCTION

Nowadays, there is a growing trend towards the integration of computational technologies to individuals' daily lives. Through the means of ubiquitous computing devices, a considerable amount of data related to natural behavior is being collected and processed instantly; serving diverse purposes, such as: diagnostic, mediation, and educative, among others. Thus, several works have aimed to study the relevance and impact of digital technologies on educational processes, notably, on how digital technologies can improve the efficiency

of learning. Among diverse aspects, the study of individual differences and motivation has been of capital importance. This has been the case, for instance, of application domains such as: knowledge or ability acquisition through persuasion (Fogg [5]), behavior engagement (e.g. study habits) to improve the learning outcomes (Filippou et al. [4]), mobile courseware design for individuals with learning difficulties (Ng et al. [14]), and mobile learning (Oyelere et al. [15]), among many others.

Our research is interested in studying the influence of individual's motivation on behavior and learning. In the context of an ubiquitous system, through the development of the *Sapiens Project*¹, we have been concerned with the research of technologies that are capable of influencing people to acquire knowledge or skills in relation to the sustainable use of electric energy. During the pilot tests of the system it was identified the need for measuring the user's initial motivation, so the system can be customized (i.e. choosing the more adequate style for recommendation and the content to be presented to the user), in order to increase the efficacy of the persuasive module. In agreement with Fogg [6], *persuasion* is viewed in our research as the attempt to influence people's behaviors and not attitude.

Among the psychological theories of motivation available in the literature, we have considered the Self-Determination Theory (SDT) framework. Several works have already resorted to SDT to study the relation between motivation and learning. In Martinelli et al. [13] the motivation profile of Brazilian elementary school students has been assessed and compared to the academic performance. In Danowitz [1] the design of a practical project for engineering students was based on the SDT framework. These studies have relied on self-report questionnaires on individuals' motivation. Given the differences in the target participants of our studies, and the lack of a relevant psychometric instrument already validated for the population of Brazilian participants, we developed a scale for measuring individuals' situational motivation, so its reliability can be established. In concrete, this work describes the employment of the SDT framework for both designing an instrument for situational motivation assessment of

¹Sapiens: <http://www.nautec.furg.br/index.php/projetos-pt/sapiens>

participants, and designing pervasive messages to increase their engagement to an ubiquitous learning system on the energy consumption reduction. The remaining of this paper is organized as follows. In Sec. II the key concepts from SDT are briefly introduced. In Sec. III the methodology behind the proposal of the scale and the persuasive messages is detailed. In Sec. IV the results of the statistical evaluation are given and discussed. Finally, in Sec. V the conclusion and perspectives of future work are presented.

II. THE SELF-DETERMINATION THEORY (SDT)

The Self-Determination Theory (SDT) is a framework for the study of human personality and motivation. According to Deci & Rian [2], behavior is based on two general sort of motives: intrinsic and extrinsic. Intrinsic motives are related to the profit of the activity itself, it is usually the case of individual's satisfaction of the need for joy, pleasure, amusement, and so on. Contrarily, extrinsic motives are related to external goals. Thus, the theory relates, by the one hand, the individual's motivation to the satisfaction of innate psychological needs (such as *autonomy*, *competence*, and *relatedness*, see Vallerand [20]); and, by the other hand, it views the motivational state as a continuum between *intrinsic motivation*, *extrinsic motivation*, and *amotivation*; depending on the degree of internalization, which originally is external but may be gradually assimilated into personally endorsed. An important assumption of SDT is that motivation is not a mere psychological correlate, but it actually leads to important consequences which can be *behavioral*, *affective*, and *cognitive* in nature. Moreover, such consequences exist in a hierarchy that defines three levels of generality, which are the *global*, the *contextual*, and the *situational* levels. As shown in Fig. 1, the SDT framework describes motivation at each level of generality based on a six-level scale, so the consequences are decreasingly positive as motivation moves from *intrinsic* to *amotivation*. In this sense, individuals experiencing *amotivation* would fail to perceive sense of purpose, expectation of reward, or the possibility of changing the course of events in relation to a given activity. Several other postulates integrate SDT, so the reader is referred to the work by Vallerand [20] to get more details.

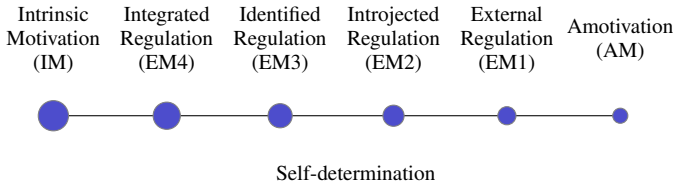


Fig. 1. SDT motivation continuum hypothesis.

III. METHODOLOGY

The study was conducted according to the following stages: (i) bibliographic research of the state-of-art scales to assess motivation; (ii) design of a data collection instrument in the form of a structured questionnaire; (iii) evaluation of the

instrument considering an heterogeneous sample; (iv) design of the persuasive messages to enhance the user engagement on the task. These stages are described bellow.

A. Related scales

Previous researches have considered the problem motivation measurement based on SDT. In Pelletier et al. [16] a scale is proposed to evaluate the motivation of patients enrolled in therapeutic counseling, in Vallerand et al. [21] an instrument is proposed to evaluate the intrinsic and extrinsic motivation (*AMS - Academic Motivation Scale*) of high school students, in Stover et al. [18] the Spanish adaptation of the AMS construct is accomplished to assess the motivation of high school students, in Li [10] a scale for evaluating exercise motivation is proposed (*EMS - Exercise Motivation Scale*). More related to the measurement of situational motivation, in Guay et al. [7] the *SIMS (Situational Motivation Scale)* is proposed.

Although related to our research, the previous works did not fit into an important goal of our study which is to evaluate the situational motivation of Brazilian adults that participate in ubiquitous learning tasks. Thus, the proposal of our instrument is in principle based on SIMS. However, this scale only includes four out of the six categories illustrated in Fig. 1. We believe that *introjected* and *integrated regulation* should not be left aside, since many ubiquitous learning situation may involve motives related to these categories (e.g. choosing to do something not to feel guilty, or based on the coherence to other aspects of the self). A scale that did included all the six categories was CMTS, but it was developed for a therapeutic context. Therefore, By attempting to develop a situational instrument based on the six categories for an use in a ubiquitous task scenario, we designed the Ubiquitous Situational Motivation Scale (USMS) which is going to be detailed next.

B. Instrument design

The instrument USMS was designed as a structured Likert Scale questionnaire ranging from 1 to 7 points, covering 6 categories of motivation described into 24 questions as follows: 4 items for *intrinsic* motivation, 4 for *integrated regulation*, 4 for *identified regulation*, 4 for *introjected regulation*, 4 for *external regulation* and 4 for *amotivation*. The scale items followed the criteria described in Table I.

C. Instrument evaluation

In the study the reliability of USMS is estimated by the means of the Cronbach's alpha coefficient analysis (see Hair et al. [8]) and the Kaiser-Meyer-Olkin criterion (KMO, in Kaiser [9])². *Principal component analysis* (PCA) is also performed, which is a statistical procedure that transforms a set of possibly correlated variables into linearly independent variables (Hair et al. [8]). The sampling was selected from non-probabilistic and intentional criteria (Marôco [12]), including subjects that

²It indicates whether the factorial analysis is adequate to the data and tests its overall consistency.

TABLE I
USMS SDT-BASED ITEMS CRITERIA (SD: SELF DETERMINED BEHAVIOR)

Profile	SD	Description
MI	Yes	The choice is based on the pleasure and satisfaction experienced while doing the activity.
EM4	Yes	The choice is not solely restricted to the importance of the activity itself, but also on its integration as a harmonious part of the self.
EM3	Yes	The activity is highly valued and judged as important for the individual.
EM2	No	Reasons are internalized and regulated by internal pressures such as guilt, anxiety, or self-esteem-related emotions.
EM1	No	The choice is based on the congruency to values and goals as established externally.
AM	No	Subjective experience of disconnection between individual's beliefs and expected behavioral outcomes.

are supposed to be typical of the population of potential users of the Sapiens system.

The instrument was developed in three stages. In the first stage the items were designed and reviewed by faculty professors of Portuguese language, a pilot evaluation was conducted in a sample of 20 students (13 females and 7 males), from different graduation schools, aged between 20 and 41 years, when participating to an extension seminar course. The second stage included some corrections to the scale sheet format, and a new pilot test with Master's and Doctoral degree participants, aged between 23 and 57 years. Finally, in the third stage the scale was applied to a sample of 585 subjects (307 female and 278 male), aged between 14 and 80 years. Participants were attached to educational institutions in both the public and private sector, including faculties (Universidade Federal do Rio Grande; e Anhanguera), technical schools (Instituto Federal de Educação, Ciência e Tecnologia; e Serviço Nacional de Aprendizagem Comercial), and high school (Escola Estadual de Ensino Médio Silva Gama). The subjects belong to diverse areas of knowledge such as geography, linguistics, letters, arts, engineering, mathematics, earth sciences, human sciences, and biology.

D. Persuasive messages design

The design of the persuasive messages was based on the criteria described in Table I. The objective was to evaluate whether students would likely respond to messages conceived to stimulate reducing the electric energy consumption consumption at the household or the office. The evaluation consisted in presenting the subjects the messages and asking them to rate their effectiveness on a 5-points Likert Scale. The instrument was applied to a sample of 227 students. The analysis of the results would allow to evaluate the potential of the messages as a means to encourage sustainable behavior.

IV. RESULTS

A. Instrument Analysis

The 24 items integrating USMS are presented in Table II. Each motivation level (see Fig. 1) is associated to a subset of four items. PCA allowed the set of items of the instrument to be grouped into four linearly independent variables or

Factors. The adequacy of a factor was evaluated based on the load (greater than 0.30), the internal consistency (Cronbach's alpha greater than 0.6, Hair et al. [8]), and the total variance explained (greater than 50%, Tabachnick et al. [19]).

TABLE II
ITEMS OF THE INITIAL VERSION OF THE USMS INSTRUMENT

Id.	Item	Profile
01	Gosto de participar ou de realizar esta atividade	IM
02	Obtenho um ganho pessoal através desta atividade	EM4
03	Faço esta atividade para o meu próprio bem	EM3
04	Preocupa-me não desenvolver esta atividade	EM2
05	Sinto que as pessoas esperam que eu faça esta atividade	EM1
06	Esta atividade não me interessa	AM
07	Esta atividade é agradável ou reconfortante	IM
08	Estou engajado em realizar mudanças para o meu bem-estar	EM4
09	Esta atividade me faz uma pessoa melhor	EM3
10	Sinto-me mal por não participar desta atividade	EM2
11	Devo fazer esta atividade	EM1
12	Não vejo o benefício desta atividade	AM
13	Esta atividade é divertida, prazerosa ou inspiradora	IM
14	Através desta atividade melhoro em outros aspectos	EM4
15	Acredito que esta atividade seja importante para mim	EM3
16	Angustia-me não concluir esta atividade	EM2
17	Não há alternativas além desta atividade	EM1
18	Preciso refletir sobre a utilidade desta atividade	AM
19	Sinto-me bem quando ao fazer esta atividade	IM
20	Esta atividade viabiliza a conquista de objetivos importantes	EM4
21	Penso que esta atividade seja importante para mim	EM3
22	Envergonha-me não ter bom desempenho nesta atividade	EM2
23	Sinto-me obrigado a fazer esta atividade	EM1
24	Não vejo motivos para realizar esta atividade	AM

The PCA evaluation of the first stage grouped the items in six sub-scales with internal consistency (Cronbach's alpha): $F_1 = 0.94$, $F_2 = 0.857$, $F_3 = 0.823$, $F_4 = 0.705$, $F_5 = 0.461$ and $F_6 = 0.632$, indicating not acceptable reliability for F_5 . The total variance explained of the sub-scales were: $F_1 = 38.17$, $F_2 = 17.16$, $F_3 = 9.79$, $F_4 = 7.39$, $F_5 = 5.9$ and $F_6 = 5.22$, which is greater than 50% (Tabachnick et al. [19]). The average value of the users' responses ranged between 1.53 and 5.19, which corresponds to the range expected for a 7-points Likert scale (Guay et al. [7]). The standard deviation ranged between 1.09 to 2.11, this would also be adequate to the variability expected.

The PCA evaluation of the second stage grouped the items in six sub-scales with the internal consistency: $F_1 = 0.933$, $F_2 = 0.709$, $F_3 = 0.704$, $F_4 = 0$, $F_5 = 0.514$ and $F_6 = 0$, indicating acceptable reliability in F_1 , F_2 , and F_3 . The total variance explained of the sub-scales were: $F_1 = 35.16$, $F_2 = 10.95$, $F_3 = 9.52$, $F_4 = 7.79$, $F_5 = 5.88$ and $F_6 = 5.8$, which is a value greater than 50% (Tabachnick et al. [19]). Factorial loads were analyzed in order to reformulate items with little correlation. The mean value of users' responses ranged between 2.48 to 5.60, which is close to the expected variation from a 7-points Likert (Guay et al. [7]). The standard deviations for each category ranged between 1.33 to 2.19, showing adequate variability the items.

In the final PCA evaluation some protocols were excluded for presenting invalidate data. This is the case of twelve sheets that contained ten or more consecutive items with the same value, this is usually considered as a non-engaged

subject performance (Likert [11]). Some items were also skipped. Four scenarios were considered for treating missing data. The first one was *excluding the item*, which resulted in four sub-scales with internal consistency: $F_1 = 0.868$, $F_2 = 0.821$, $F_3 = 0.682$, and $F_4 = 0.55$, indicating not acceptable reliability for F_4 , the total variance explained were: $F_1 = 30.66$, $F_2 = 11.41$, $F_3 = 7.08$, and $F_4 = 5.19$, which is greater than 50% (Tabachnick et al. [19]). The second one was *assigning the average of the whole sample*, which resulted in four sub-scales with internal consistency: $F_1 = 0.864$, $F_2 = 0.782$, $F_3 = 0.728$, and $F_4 = 0.628$, indicating acceptable reliability, the total variance explained were: $F_1 = 30.34$, $F_2 = 11.17$, $F_3 = 7.1$, and $F_4 = 4.79$, which is greater than 50% (Tabachnick et al. [19]). The third one was *assigning the average of the sub-sample to which the subset belongs*, which resulted four sub-scales with internal consistency: $F_1 = 0.876$, $F_2 = 0.782$, $F_3 = 0.728$, and $F_4 = 0.628$, indicating acceptable reliability, the total variance explained were: $F_1 = 30.29$, $F_2 = 11.17$, $F_3 = 7.09$, and $F_4 = 4.78$, which is greater than 50% (Tabachnick et al. [19]). Finally, the fourth one was *assigning the average of item category calculated for the individual*, which resulted in four categories (see Table III), with internal consistency: $F_1 = 0.881$, $F_2 = 0.797$, $F_3 = 0.711$ and $F_4 = 0.641$, indicating acceptable reliability, the total variance explained was: $F_1 = 30.89$, $F_2 = 11.38$, $F_3 = 7.29$ and $F_4 = 4.84$, which is greater than 50%. The last scenario was chosen since it presented the best results.

TABLE III
PCA MATRIX: GROUPING OF ITEMS PER FACTORS

Item	Factors			
	F_1	F_2	F_3	F_4
13	.829	.114	.033	-.068
19	.809	.232	.104	-.034
07	.787	.192	-.008	-.041
01	.691	.247	.026	-.097
09	.629	.303	.267	-.082
14	.531	.380	.247	-.128
15	.468	.403	.409	-.254
20	.139	.685	.357	-.136
03	.309	.637	.115	-.068
02	.289	.633	.080	-.015
08	.261	.621	-.118	.106
21	.352	.569	.377	-.210
11	.034	.491	.465	.029
16	.086	.067	.788	-.030
10	.250	-.066	.744	.059
22	-.167	.232	.607	.177
04	.191	.388	.546	.027
18	.207	-.113	.018	.657
23	-.293	.181	.254	.615
17	-.284	.134	.225	.542
12	-.155	-.394	-.289	.538
24	-.165	-.363	-.217	.513
06	-.331	-.310	-.173	.458
05	.127	.306	.239	.420

Factor F_1 , included 7 items from the categories intrinsic, integrated and identified regulation, with the factorial loading varying between 0.468 and 0.829. This factor can explain

30.89% of the total variance, it is without doubt the most relevant factor to be considered in the analysis of situational motivation of individuals when they perform a certain activity. Factor F_2 included 6 items from the categories integrated, identified and external regulation, with the factorial loading varying between 0.491 to 0.685. Factor F_3 included 4 items from the category introjected regulation, with the factorial loading varying between 0.491 to 0.685. Finally, factor F_4 included 7 items from the categories external regulation and amotivation, with the factorial loading that varied between 0.420 to 0.657.

These results pointed out the need to transform the 24-items version of USMS to a more homogeneous instrument. Thus it was attempted to reduce the scale to four items per factor. However, F_4 for this version obtained a Cronbach's alpha of 0.56, wich is considered to be below the reliability limit (Hair et al. [8]). Thus, we chose to reduce the instrument to 18 items (excluding items 15, 9, 14, 5, 6, 11).

TABLE IV
MATRIX ROTATED WITH THE FACTORIAL LOADS FOR THE 18 SELECTED ITEMS

Item	Factors			
	F_1	F_2	F_3	F_4
13	.826	.172	.072	-.098
19	.799	.294	.132	-.049
07	.787	.234	.026	-.073
01	.701	.290	.075	-.124
20	.065	.726	.350	-.110
02	.249	.673	.104	-.021
03	.261	.666	.120	-.081
08	.228	.638	-.094	.090
21	.275	.612	.369	-.206
16	.049	.098	.794	-.016
10	.218	-.038	.774	.020
22	-.186	.252	.612	.227
04	.139	.398	.565	-.011
18	.258	-.121	.030	.672
23	-.271	.157	.239	.672
17	-.273	.117	.193	.582
24	-.129	-.366	-.241	.549
12	-.119	-.380	-.305	.526

The KMO criterion was calculated for the short version, it corresponded to a value of 0.871, which is considered to be acceptable (Field [3]). The internal consistency values (Cronbach's alpha) of the sub-scales were: $F_1 = 0.861$; $F_2 = 0.789$; $F_3 = 0.711$ and $F_4 = 0.615$, which explain 58.5% of the total variance. The variance of the sub-scales were: $F_1 = 29.71$, $F_2 = 13.57$, $F_3 = 8.9$ and $F_4 = 6.32$.

As shown in Table IV, the F_1 items presented factorial loadings that ranged between 0.701 and 0.826. This factor explains 29.71 % of the total variance, it is considered to be the closest to intrinsic motivation; followed by F_2 that presented a factorial loading ranging between 0.612 and 0.726; F_3 with a factorial loading varying between 0.565 and 0.794; and F_4 presenting a factorial loading that ranged between 0.526 and 0.672. This last one is thus considered to be the closest to amotivation (see Fig. 1).

The continuity hypothesis between factors was evaluated based by a correlation analysis. Table V shows inter-factor correlations, thus adjacent sub-scales should correlate more positively than distant sub-scales. For example, as seen on the table F_1 correlated positively with F_2 ($r = 0.33$), but negatively with F_4 ($r = -0.17$). The procedure by Ryan & Connell [17] was also considered to analyze the continuity hypothesis. Thereby, an adjacency index is assigned to the correlations between the sub-scales, by considering the inter-factor proximity, such that: $r(F_2, F_4) = 3$, $r(F_1, F_3) = 2$, $r(F_1, F_4) = 1$, and $r(F_2, F_3) = 1$. This analysis revealed a congruence coefficient of 0.77, showing that about 59% of the variance in the correlations of this pattern was explained by the adjacency index.

TABLE V
MATRIX OF CORRELATIONS BETWEEN FACTORS

	F_1	F_2	F_3	F_4
F_1	-			
F_2	0.334	-		
F_3	0.114	0.244	-	
F_4	-0.169	-0.138	-0.012	-

B. USMS situational profile

The USMS instrument was applied to participants in three distinct contexts: (i) the classroom activities, to 488 subjects (261 females, 224 males, and 3 unreported), aged between 14 and 80; (ii) the library spontaneous activities, to 13 subjects (7 females, 5 males, and 1 unreported), aged between 18 and 42; and (iii) leisure activities, to 82 subjects (40 males, 40 females, 1 transsexual, 1 unreported), aged between 18 and 55. Table VI shows the results obtained. The study pointed out differences in the participant's motivation profile according to the context. As shown in Fig. 2, participants to leisure activities presented proportionally higher scores in F_1 than the library or classroom contexts, these subjects also showed lowest scores in F_4 . For all situations the results appear to be consistent with the SDT continuum hypothesis, since the mean rates per factor follow a concave trend for all the contexts. Moreover, a qualitative evaluation of the results suggests that participants of classroom activities presented higher F_4 mean scores when compared to others (which is closest to the amotivation extreme, see Fig. 1).

TABLE VI
CONTEXT MEAN μ AND STANDARD DEVIATION σ

Factor	Leisure		Library		Classroom	
	μ	σ	μ	σ	μ	σ
F_1	5.8	1.06	5.2	1.27	4.8	1.36
F_2	5.3	1.27	6.1	0.9	5.5	1.05
F_3	4.4	1.65	4.8	1.27	5	1.36
F_4	3.2	1.22	2.9	1.06	3.3	1.13

Due to the fact that the individuals who were participating to classroom activities presented proportionally lowest levels of intrinsic motivation, we analyzed qualitatively this category based on different types of educational institutions profiles.

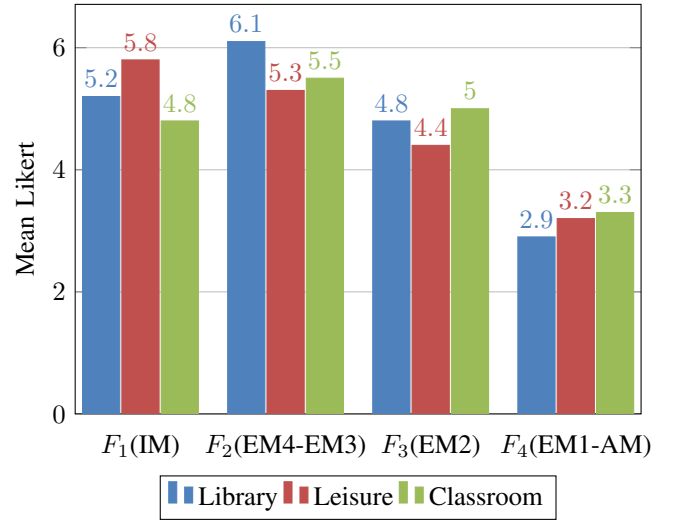


Fig. 2. USMS mean scores grouped by contexts.

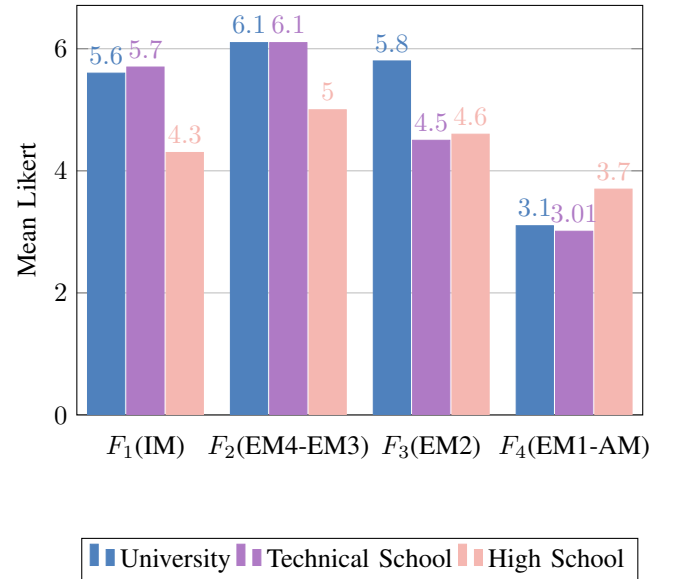


Fig. 3. USMS mean scores and classroom student profiles.

Thus, as shown in Fig. 3, students enrolled in technical school presented higher rates of F_1 , while students enrolled in high school presented the higher rates of F_4 . Table VII shows that sample dispersion in the categories analyzed is low, so the responses to the items are close to the mean values.

TABLE VII
MEAN μ AND STANDARD DEVIATION σ FOR ACADEMIC PROFILES

Course	F_1		F_2		F_3		F_4	
	μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4
University	5.6	1.1	6.1	0.89	5.8	1.1	3.1	1.5
Tech. Sch.	5.7	0.92	6.1	0.93	4.5	1.2	3.01	1.13
High School	4.3	1.22	5	1.08	4.6	1.39	4.7	1.1

TABLE VIII
EXAMPLE OF PERSUASIVE MESSAGES DESIGNED

Category	Persuasive Message
F_1 (IM)	Your TV is on, let's have some fun, press this button to turn it off!
F_2 (EM4-EM3)	Achieve your goal of becoming an environmentally friendly person, you forgot your TV on please turn it off!
F_3 (EM2)	70% of our consumers are switching off the TV when not using it! Let's join them!
F_4 (EM1-AM)	You can save R\$ 3.31 if you turn your TV off regularly this month!

C. Persuasive messages designed

The persuasive messages were designed based on the SDT categories (see Fig. 1), though after the evaluation of USMS, they were grouped according to the resulting four factors. The likelihood of responding to the messages was evaluated in a 5-points Likert scale. Table VIII presents some examples of the messages that were better ranked by the subjects.

V. CONCLUSIONS AND PERSPECTIVES

In order to adequate the communication module of the system Sapiens for the learning of efficient energy consumption, this work has proposed to develop an instrument to evaluate the level of situational motivation of individuals, and to design persuasive messages to increase the engagement on the task, based on the motivation profiles described by the SDT framework. The proposed scale was named USMS. It was composed by 18 7-points Likert items grouped into four categories, that measured subjects motivation along a continuum between intrinsic and amotivation.

USMS was applied in three distinct context (leisure, the library, and the classroom). The analysis of the results suggested that students' motivation scores varied according to the context. Thus, leisure activities appeared to be more related to intrinsic motivation. Contrarily, participants to classroom activities presented proportionally higher levels of extrinsic motivation. Within the classroom activities, technical students presented rates that proportionally tended more to the intrinsic motivation extreme than high-school students. This seems to be consistent with SDT assumption that individuals internalize motives so they become gradually assimilated into personally endorsed, though the construct validity of USMS has still to be established.

From the profiles obtained in the proposed instrument, a set of persuasive messages were designed to be integrated with the Sapiens system. A preliminary assessment suggested that the messages would be received favorably by potential users. From these results, in future work we intend to establish the construct validity of USMS, and to assess the motivational profile of participants, so they receive appropriate messages through a mobile application. The USMS measurements of the subjects' motivation will also allow us to design a correlation study where behavioral measures can be related to the motivational factors, we believe that this would improve significantly the usability of the system.

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