An Evaluation of INFIRO International Summer School

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This paper is intended to investigate the degree of students' satisfaction with INFIRO Summer School of robotics, electronic and computerized laboratory. Research showed that predictors as interactions, self-efficiency and self-regulations are suitable measures which contribute to student satisfaction in open learning systems. Descriptive statistics was performed to determine the contribution of predictor variables to student satisfaction. A degree of overall students' satisfaction with INFIRO Summer School is 4.6 from 5. The results also showed that learner-instructor interaction, learner-content interaction, and online and offline self-efficacy were good predictors of student satisfaction. Interactions among students and self-regulated learning have to be considered carefully. A learner-instructor and learner-content interactions are indicated as most significant.

Key-words: Open learning, Student Satisfaction, INFIRO Summer School

1. INTRODUCTION

Summer schools of Technology Education are very effective learning pathway in open learning systems [1]. Open learning (OL) refers to minimal constraints on access, pace and method of study. The term is often used to encourage traditional institutions to minimize barriers between themselves and aspiring learners. OL is very important factor to boost and develop technological literacy [2, 3] which is in domain of Technology Education (TE) curriculum. Technological literate (TL) students should be able to understand and evaluate/judge/asses technology and to help consciously and efficiently transform the natural world into the human environment. TL can be seen as technological competences complement; the ability to create, repair, and implement technologies which students learn in the context of TE [2]. Academic leaders around the world indicated that open and distance learning is critical to the long-term growth of their institutions, reporting that the increase in demand for open courses or programs is greater than that for face-to-face courses. According to previous studies, open learning does not differ considerably from traditional face-to-face classroom learning in terms of learning outcomes [4]. Student satisfaction in open learning remains undiminished when compared to face-to-face instruction [5].

Student satisfaction is an important indicator of the quality of learning experiences [4]. It is worthwhile to investigate student satisfaction in open settings because new technologies have altered the way that students interact with mentors/instructors/tutors and classmates [4, 6]. The quality of interaction in open settings may depend to a large extent on the technology tools utilized during learning [4, 7]. Lack of confidence in using information and communication technology (ICT) may decrease students' satisfaction during open instruction and in turn lower their performance. As opposed to face-to-face instruction, the nature of open learning demands greater responsibility on the part of learners [2,4]. Open learners who are unable to regulate learning efficiently are unlikely to be satisfied [8,9]. This study investigated factors (i.e., Interactions, self-efficacy, self-regulation) associated with student satisfaction in fully open learning settings.

2. LITERATURE REVIEW

In this part, student satisfaction and predictors of student satisfaction are investigated.

2.1 Student satisfaction

Student satisfaction can be experienced in a variety of situations and connected teaching/learning. It is a highly personal assessment that is greatly affected by student expectations. Satisfaction also is based on the student's experience of both contact with the organization and personal outcomes [10].

Evaluation is important in open education and it consists of different dimensions in alignment with the goals of a course or program. Course grades are often used as an indicator of student achievement in open instruction [4]. But affective factors can be as important as cognitive factors in explaining and predicting student learning in open settings [11]. Among the attitudinal constructs, student satisfaction, referring to student perceptions of learning experiences and perceived value of a course, may be particularly worthy of investigation. Student satisfaction is related to several outcome variables such as persistence [5], retention [4], course quality [12], and student success [13]. High satisfaction leads to lower attrition rates, higher persistence in learning, and higher motivation in pursuing additional open courses [5,10]. Education institutions consider student satisfaction as one of the major elements in determining the quality of open programs in today's markets [4]. Open learner perspectives provide valuable information on the areas that matter to students and help institutions gain a better understanding of their strengths and challenges in provision of open programs [13]. With data on student satisfaction, course designers, educators, and administrators can identify areas where improvement is needed [4,9]. Student satisfaction data can be used also students' degree choice. Furthermore, these data challenge stereotypes of the experiences of males and females in TE and have implications for how TE teaching practitioners approach the learning experience of their students.

2.2 Predictors of Student Satisfaction

Previous studies have determined factors that influence student satisfaction in open and distance learning environments [4]. The framework of this study was proposed based on the interaction model developed by [14] with the addition of potential variables including self-efficacy and self-regulated learning.

2.2.1 Interactions

Interaction has been deemed one of the most important components in open and distance education due to the computer oriented work and partially isolation of instructors and learners [12]. An interaction framework was proposed including learner-learner interaction, learner-instructor interaction, and learner-content interaction [14].

Learner-learner interaction refers to two-way reciprocal communication between or among learners who exchange information, knowledge, thoughts, or ideas regarding course content, with or without the presence of an instructor [12]. Learner-instructor interaction consists of two-way communication between the instructor of a course and learners. Learner-content interaction is a process of individual learners elaborating and reflecting on the subject matter or the course content. In contrast with learner-instructor and learner-learner interaction, only one person – the learner – is directly involved in learner-content interaction [12]. At OL, new types of interactions were found, namely: instructor-instructor, instructor-content, and content-content interaction [4].

Previous research has indicated the positive influence of interaction on student satisfaction in open and distance education [4]. Of the three types of interaction, learner-learner interaction and learner-instructor interaction were investigated more often than learner-content interaction. Learner-learner interaction and learner-instructor interaction seem to be more related to and predictive of student satisfaction than learner-content interaction in most studies of open learning [4]. Learner-instructor interaction was the most required interaction in his summary from several open studies [15]. However, the findings are inconclusive. Some studies indicated that the amount of interaction that learners have with the content is most important to student satisfaction in computerized laboratory based learning, in comparison with learner-learner interaction and learner-instructor interaction [4].

2.2.2 Self efficacy

Expanded from the self-efficacy theory in psychology [16], researchers in education have indicated that efficacy beliefs positively influence achievement and persistence related to specific instructional tasks [17]. Online and offline self-efficacy (ONOFSE) refers to the belief in one's capability to organize and execute computer-related actions required to accomplish assigned tasks [4]. There are two reasons to include ONOFSE

as a predictor of OL student satisfaction. First, OL relies on ONOFSE delivery through which various types of activities take place such as computer design and implementation, measurements, collaborative projects, communication with instructor or classmates, and so on [4,9]. Technical problems while using the computer, computer based devices, and equipment may cause student frustration and dissatisfaction [4,10]. It seems important for OL learners to possess high ONOFSE to complete required tasks for an open course delivered through the computerized laboratory.

Secondly, ONOFSE, as one of the three self-efficacy constructs in computer-based instruction, is less addressed than academic self-efficacy or computer self-efficacy. The impact of ONOFSE on student satisfaction is scarce and inconclusive (High School, University) while for Primary School students is significant. ONOFSE is positively correlated with expected outcomes including entertainment, social, and informational outcomes what is indicated in [4].

2.2.3 Self-regulated learning

Self-regulation, originally from psychology, was first defined by [18]. The central ideas underlying self-regulation are motivation and learning strategies that students utilize to achieve their learning goals. The scope of self-regulation has been expanded to studies in education areas [4,9]. Self-regulated learning refers to the degree to which students metacognitively, motivationally, and behaviourally participate in their own learning [19]. Metacognitive processes involve learners' ability to plan, schedule, and evaluate their learning progress. Motivational processes indicate that learners are self-motivated and willing to take responsibility for their successes or failures. Behaviour refers to the characteristics of the strategies that students utilize to optimize learning [19]. The importance of self-regulation in student performance is evident in traditional face to- face learning settings [19] and Blended Learning settings [10]. Unlike traditional classroom instruction, open learning is student-centered and much self-directed effort is required for success [20]. Although most of the studies have indicated that the ability to self-monitor and self-evaluate at different learning stages is positively related to student performance or achievement, there is very limited research pertaining to the association between self-regulation and student satisfaction. The motivational components of self-regulation are positively related to student satisfaction [20]. Meta-cognitive self-regulation is positively correlated with student satisfaction at a significant level is indicated by [8]. This study also focuses on metacognitive self-regulation because metacognitive processes are considered to be the most critical in self-regulation [19,20].

3. METHOD

Sample, Instrumentation, and Procedure and Data Analysis of our study are described in the following text.

3.1 Sample

The sample of this study consisted of Secondary School students enrolled in summer-session open courses of INFIRO Summer Schools. First Infiro Summer School 2012 was held in June 2012, 17-23 and the second one was held in June 2013, 23-29. The venue of Infiro Summer School is Rabac, Croatia. The summer-session courses were 1 week long. With the permission of and assistance from the parents and instructors who agreed to have their students participate in the study, a paper and pencil survey was distributed. All of the enrolled students completed the survey. There were more male respondents than females (Table 1). Most respondents were between the ages of 14 and 16 years. There were only a few students less than 14 and over 16 years old. In INFIRO Summer school 2012, just two INFIRO project countries had recruited the participants, namely Croatia and Slovenia. In the second INFIRO Summer School, 2013, all INFIRO project countries (Croatia, Slovenia, Turkey, and Romania) have been involved in open learning, most participants came from Croatia and Slovenia.

Table1. Participants of the INFIRO Summer School 2012 and 2013

Participants	2012 Frequency [/]	2013 Frequency [/]
Total	44	61
Male	36	52
Female	8	9

3.2 Instrumentation

The survey included 15 questions on three predictor variables, and student satisfaction. Instrument development was involved for interaction and student satisfaction scales. Overall student satisfaction is 5-point Likert Scale with 4 items that ranged from 1 (*very unlikely*) to 5 (*very likely*). Questions on the ONOFSE were developed to measure one's confidence in the ability to be successful in performing certain tasks using computer-based technology. The self-regulated learning scale was adopted from the metacognitive self-regulation subscale in the Motivated Strategies for Learning Questionnaire (MSLQ) . The scale is a 3-point Likert scale with 4 items ranging from 1 (*not at all true of me*) to 7 (*very true of me*). It assesses the extent to which learners used planning, monitoring, and regulating strategies during the learning process. Beside this, also open ended questions about judgement, expectations, decision making, behaviour and affective part are included.

3.3 Procedure and Data Analysis

The survey was administered, use of paper and pencil method when INFIRO Summer School has ended. High response rate was obtained by direct presence of mentors and survey administration. Data analysis was conducted using Excel. Descriptive analyses were conducted to present the student basic information and the average score of predictor sub-variables and student satisfaction.

4. RESULTS

An evaluation of the INFIRO Summer School (ISS) is grounded on the evaluation of the ex-post questioner which was administered to students, on site, paper and pencil method.

Figure 1 illustrates average scores of students' satisfaction with INFIRO Summer School (ISS). Satisfaction scale is divided into four subscales at range 1-5. Participants of the ISS are most satisfied with work and approaches of mentors and tutors, the weakest point is accommodation and meals where most complaints go to the meals. An improvement is done at physical learning environment. Overall rank is very good to excellent.

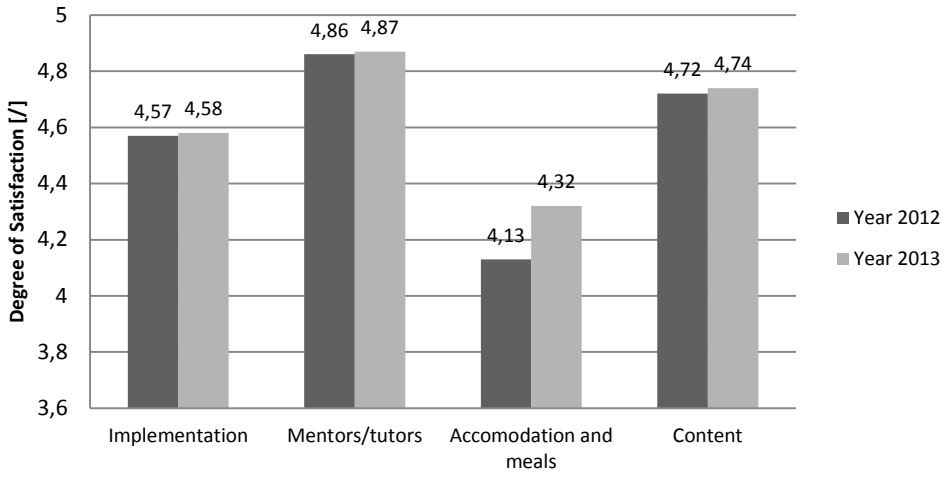
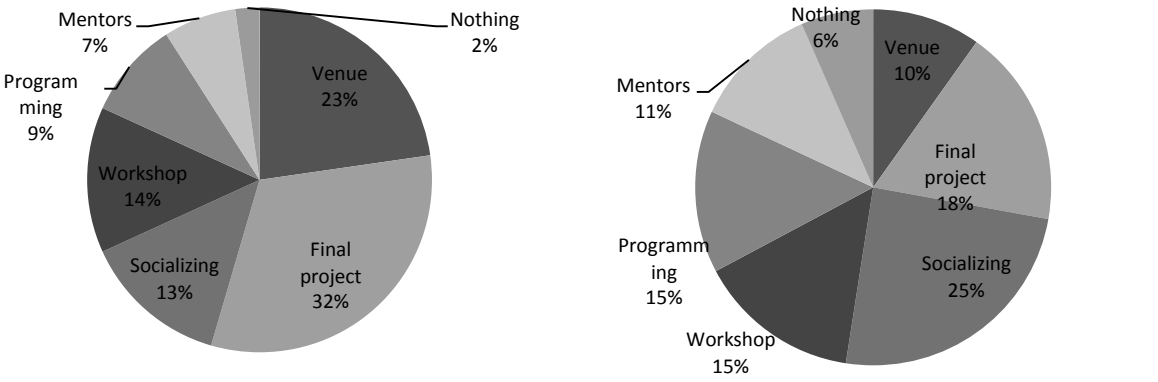


Fig.1. Overall students' satisfaction

Students also expressed their emotional/perception impressions and opinions (Fig. 2). At ISS 2012, students were most impressed with final project implementation and evaluation (32 %) and venue of ISS (23 %). Workshops and method of open learning is recorded at 14 % valuable. While, at ISS 2013, students have gained/developed social components (25 %) and were impressed by the successful final projects' operation/implementation and evaluation (18 %).



a) b)

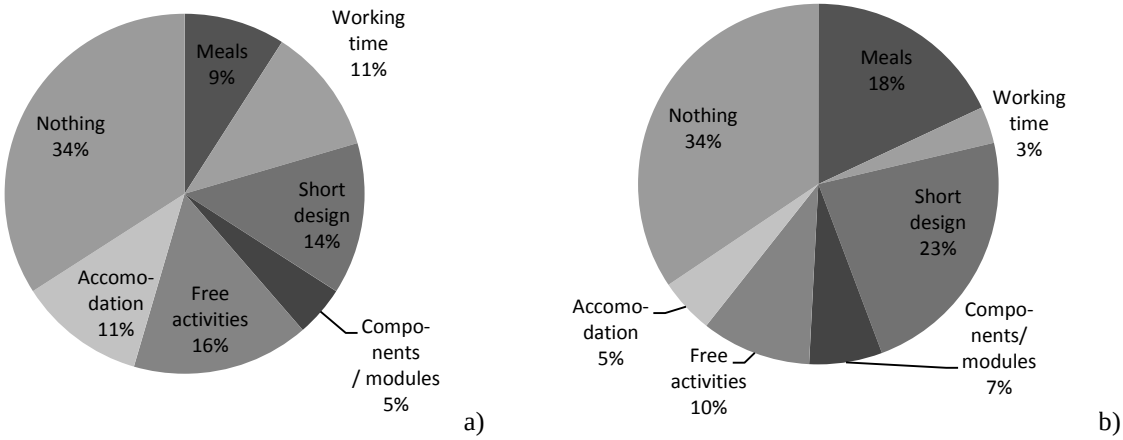
Fig.2. Students first impressions in a) ISS 2012, b) ISS 2013

Participants of the ISS 2012 had estimated the mentors (work, approach, willingness to help...) as the most valuable part (71 %), also organisation of the ISS is commended a lot (20 %). The same is indicated also for ISS 2013. This depicts strong mentor-learner interactions (Fig.3).

a) b)

Fig.3. Most positive-desirable attitude in a) ISS 2012, b) ISS 2013

Most participants are satisfied with ISS 2012 (34 %), remarkable 16 % of participants have complained on free social activities. A part of participants wanted to work and to learn more. A lack of rotation of the groups where everyone can be assigned with electronics and robotics as well (14 %) is detected. An extension of working time is suggested. Also problems exist with the meals (9 %). Working time is not suitable for 11 % of attendees. They suggest postponing start of workshops for 1 hour and in the evening; it uses to be prolonged of 2 hours. During the hottest period of the day, it must be not so work active time. Students have also complained about working place and air-condition, which was not proper (11 %). They have estimated (Fig.3) a lack of modules and components for effective work (5 %).



a) b)

Fig.4. Most negative-undesirable attitude in a) ISS 2012, b) ISS 2013

Most participants are satisfied with all (34 %); remarkable 23 % belongs to short design of the ISS 2013. A part of participants wanted to work and to learn more. Also they missed a rotation of the groups where everyone can be assigned with electronics and robotics as well. An extension of working time is suggested. Also problems exist with the meals, but it is better than previous year overall score.

Willingness/readiness to participate on next ISS is indicated in ISS 2012. Majority of the students (93 %) want to attend at the ISS 2013, just 5 % are not willing to do, while 2 % are undefined. The situation at ISS 2013 is similar.

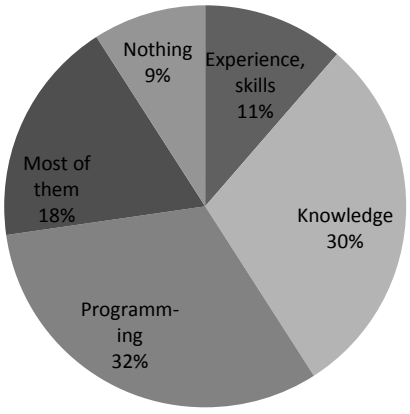
Needs fulfilment in ISS 2012 is remarkable. Most, 52 % of the students are satisfied with all what they expected (level 3), while 46 % of the students are also satisfied in majority what they expected before (level 2). Just 2 % of the attendees are partly fulfilled (level 1). For the ISS 2013 is similar. Most, 51 % of the students are satisfied with all what they expected, while 46 % of the students are also satisfied in majority what they expected. Just 3 % of them are partly fulfilled.

Complexity/difficulty of the ISS 2012. Just 4 % of the students marked as complex (level 3), while majority (89 %) of the attendees assessed ISS as medium difficulty (level 2). For the ISS 2013, 12 % of the students indicate as complex, while majority (72 %) of the attendees had assessed ISS as medium difficulty.

Entertainment and social part of the ISS. At ISS 2012 majority (80 %) of the attendees of the ISS confirm an entertainment component as medium (level 2). Just 2 % of participants argue that entertainment was not enough engaged here (level 1). For the ISS 2013, majority (79 %) of the attendees of the ISS confirm an entertainment component as moderate (level 2). Just 6 % of participants argue that entertainment was not enough engaged here.

Availability of free time/activities. At ISS 2012, 75 % of attendees had estimated just right share of free time versus working time, while 18 % confirmed a lack of free time. At ISS 2013, 61 % of attendees have assessed just right share of free time versus working time, while 23 % detected a lack of free time.

Transferable deliverables of the ISS (Fig.5). At ISS 2012, Programming knowledge and skills (32 %) will be very useful for further study. This is estimated surprisingly very high and this behaviour is more typical for summer school of computing. Participants argue that professional knowledge of electronics and robotics (30 %) will be transferable for future study and work. Also, 11 % of attendees estimate gained workshop skills and experience as positive result for future work. All deliverables will be used for 18 % of attendees. **At ISS 2013**, participants argue that professional knowledge of electronics and robotics (33 %), and programming knowledge and skills (28 %) will be very useful for further study. Also, 18 % of attendees estimate gained workshop skills and experience as positive result for future work.



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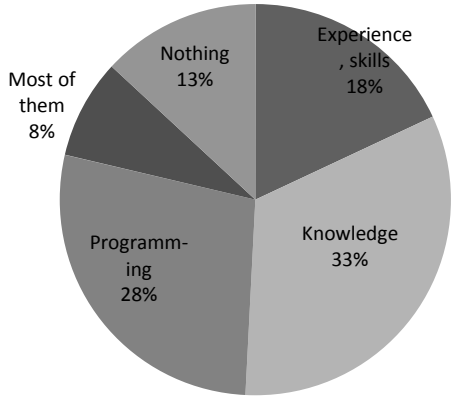

b

Fig.5. Transferable deliverables in a) ISS 2012, b) ISS 2013

Possible novelties in ISS (measuring electric current, voltage comparator, soldering, R-S flip-flop, Bascom, voltage measuring, a-stable multi-vibrator, transistor usage, electric circuits simulation software, team/pair work).

Fig. 6 illustrates pre-acquaintance with the ISS features. In ISS 2012, there are 1/3 of students which are not so common with the ISS professional features/content. This group of students was insufficient assigned with electronics and robotics in Secondary School. Just 12 % of attendees are very natives with ISS, while 18 % present a group of beginners for the ISS design. The rest of attendees are already acquainted with some of them

to half of ISS features (54 %). They were assigned with electronics and robotics at optional subjects in Secondary School and this information was useful for workshop group design to improve efficiency of the workshops. We can conclude that a good target group was established for piloting first ISS 2012. Attendees from Croatia and Slovenia have possessed at least basic to medium knowledge of electronics and robotics, with some advanced exceptions.

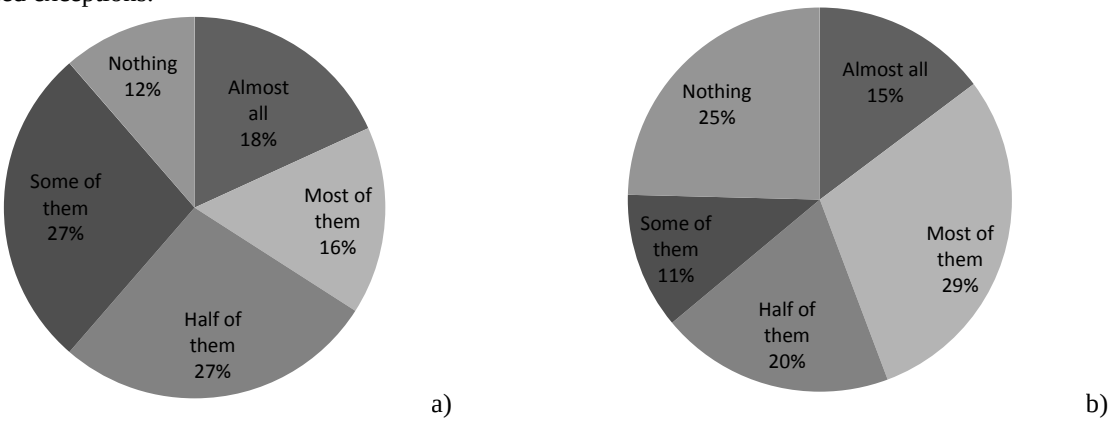

Fig. 6. Pre-acquaintance with ISS professional features/content in a) ISS 2012, b) ISS 2013

In ISS 2013, there are two remarkable groups of students. The first one of 25 % is already acquainted with all of ISS professional features/content. This group of students was already assigned with electronics and robotics at optional subjects in Secondary School and this information was useful for workshop group design to improve efficiency of workshops. The second group of 29 % of participants where majority of listed features present novelties. Some students (15 %) are very beginners in ISS, as it is designed for the INFIRO purpose. We can conclude that a good balance of the learning and training content is existed.

Organisation of the social/sports activities in ISS. In ISS 2012 (89 % satisfied students) had organised social-sports activities remarkably. Especially a visit to the Adrenalin Park, and region sights have fulfilled majority of attendees' expectations. In ISS 2013 (62 % satisfied students) had less organised social-sports activities than ISS 2012 (89 % satisfied participants). Students have mentioned a lack of organisation of theses sort of activities, possible guided tour at regions sights/attractions or visit to adrenalin park as it was in ISS 2012. A lack of social games was recorded.

Uniforms (T-shirts) for participants. In ISS 2012 majority of participants (91 %) was very satisfied with T-shirts got. Just 9 % were recorded as not proper, because of colour and signs. In ISS 2013, majority of participants (69 %) was satisfied with T-shirts got. 13 % of students were not satisfied at all, while the rest of them preferred different colours as blue, red, purple, and a pink one for the girls. Also they've missed larger symbols/logos on the uniforms.

Information channel/path. In ISS 2012, the most of the participants (52 %) were informed about in School (teachers, pedagogues etc.). Also web information about ISS was available via national Technology and Engineering Associations (27 %) and some of them (16 %) were informed by friends and parents. In ISS 2013, the most of the ISS participants (55 %) were informed about in School (teachers, pedagogues etc.). Also web information about ISS was available via national Technology and Engineering Associations (16 %) and some of them (15 %) were informed by friends and parents (Fig.7).

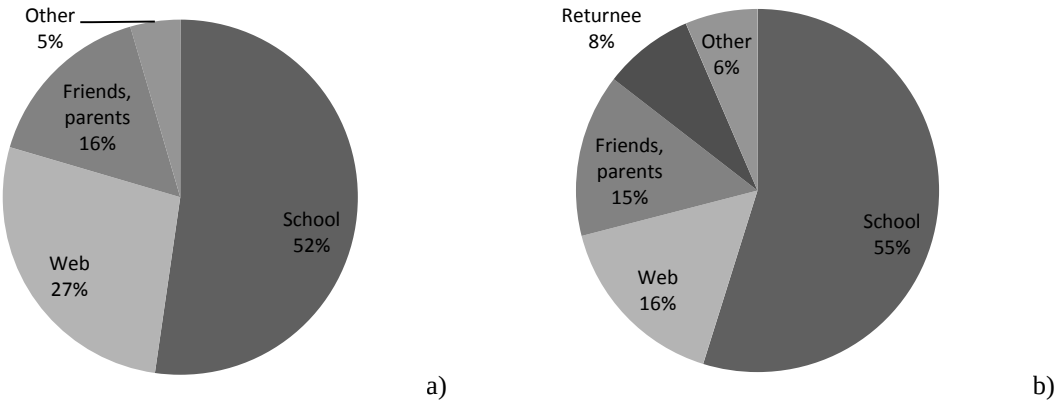

Fig.7. Information channel in a) ISS 2012, b) ISS 2013

Decision-making factors for the ISS attendance. In ISS 2012, most participants were very interested for the ISS, because of personal interest (48 %) and ISS content (16 %). Parents and friends have influenced at 18 % as well as other factors such are, the previous experience with similar summer schools, venue etc. In ISS 2013, the content of the ISS and personnel interest had attracted almost 2/3 of participants to take part at ISS. Venue of the ISS (10 %) was also decisive as well as other factors such are parents influence, the previous experience with ISS or similar, friends etc (Fig.8).

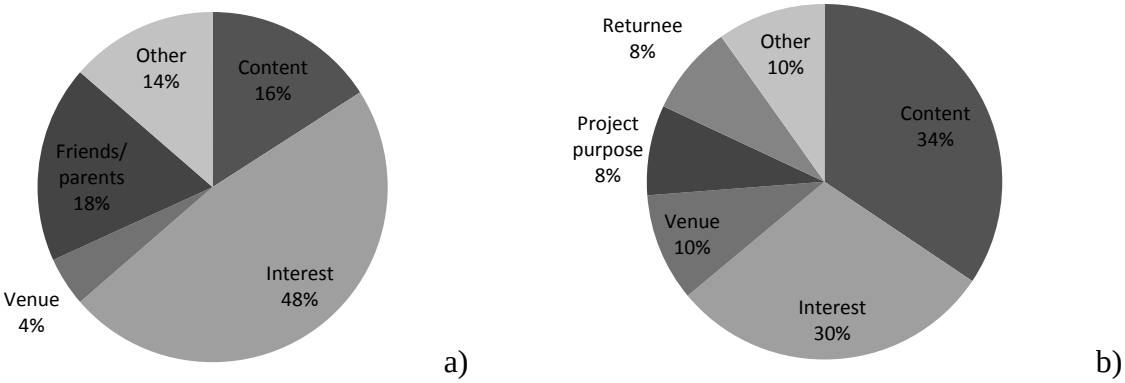

Fig.8. ISS decision making factors in a) ISS 2012, b) ISS 2013

5. CONCLUSIONS

The purpose of this study was to investigate student satisfaction with INFIRO Summer School as a measure of lesson-course and learning quality. We found that students overall satisfaction is high, 4.6 from 5. This indicates very good to excellent INFIRO Summer School design and implementation. Investigation was also oriented on student satisfaction predictors where significant and valid confirmation was found. Learner-instructor interaction, learner-content interaction, and online-offline self-efficacy were significant predictors of student satisfaction in fully open learning settings, while learner-learner interaction and self-regulated learning did not predict significantly student satisfaction. Learner-instructor interaction was the strongest predictor among those significant predictors of student satisfaction. The importance of the interactions in open learning was confirmed.

The practical implications of this study are that both instructors and course designers should pay attention to content design and organization given that learner-instructor interaction substantially contributes to student satisfaction. Instructors should pay attention to students and provide feedback to students in a timely fashion or encourage students to ask questions through different mechanisms. Implementing a technology training orientation before open courses start may help increase students' confidence in performing online-offline-related tasks required by the course and in turn enhance student satisfaction. Gender seems to be good indicator of the amount of interaction among learners. Instructors are encouraged to design more collaborative activities in Primary and Secondary School courses to enhance learner-learner interaction. Time spent online/offline may inform instructors about students' online-offline self-efficacy and self-regulation level.

Further research is required to replicate these findings amongst the other samples/target groups, and to identify whether there are specific variations in teaching practices that are particularly salient to the satisfaction of female students. Furthermore, future research should also explore the possibility that these results could be explained by gender differences.

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