# SELF-EFFICACY AND STUDY BURNOUT AMONG IT STUDENTS: CHALLENGES AND POTENTIALS

**Miitta Järvinen*, Janne Roslöf**, Joni Lämsä*, Raija Hämäläinen*, Lauri Kettunen****

* Faculty of Education and Psychology
** Faculty of Information Technology
University of Jyväskylä, Jyväskylä, Finland

## ABSTRACT

There is a risk of student dropout in the field of engineering, particularly in the domain of information technology. To find novel pedagogical and technological solutions to prevent student attrition, we must better understand student experiences regarding their learning and studying processes. This study was conducted within the introduction of a new engineering degree program at the University of Jyväskylä and focused on first-year students. The research questions are: How do IT students experience study burnout at the beginning of their studies? What kind of self-efficacy beliefs do IT students have at the beginning of their studies? How are the self-efficacy beliefs of IT students associated with their levels of study burnout at the beginning of their studies? Student experiences were gathered through a validated survey that measured student self-efficacy beliefs and their experiences regarding study burnout. The results indicate that most students have high self-efficacy beliefs but, at the same time, a few of them experience quite a high study workload stress at the beginning of their studies. Studying the development of the student experiences over time provides an understanding of the relations between the experiences of study burnout and self-efficacy. This knowledge may support the development of novel pedagogical and technological solutions so that students may be provided timely guidance, leading to improved student well-being and ultimately to decreased dropouts in the field of engineering.

## KEYWORDS

Engineering education, Learning experiences, Burnout, Self-efficacy, Student attrition,
CDIO Standards: 10, 12

## INTRODUCTION

There is a risk of student dropout in the field of engineering, particularly in the domain of information technology (IT). Typically, only half of the engineering students ever graduate (Schuman et al., 1999). Research indicates that a significant portion of students discontinue their studies during the first academic year (Watson & Li, 2014). Such is the case in Finland. Between 2005 and 2020, approximately 255,000 students started their bachelor's studies in Finnish universities, and 188,000 received a bachelor-level degree. In the field of information and communication technologies (ISCED 06; see e.g. UNESCO, 2015) the respective figures

for new students and graduates between 2005 and 2020 were 20,000 and 12,000. That is, the total graduation rate was approximately 74%, whereas in the field of IT, the total graduation rate was only 57% (Vipunen, 2021). Although the student intake among different fields and programs has varied over the years, the difference is clear.

The factors associated with engineering student attrition include issues regarding classroom and academic climate, experiences of low academic achievement and conceptual misunderstanding as well as topics in self-efficacy, self-confidence, social integration and career goals (Araque et al., 2009; French et al., 2005; Geisinger & Raman, 2013; Tinto, 1975). Many engineering education researchers and developers have sought ways to improve student retention. For example, introduction of active learning strategies, elements balancing the ratio between theoretical and practical contents in the beginning of the studies, and different student care activities have been introduced (Bennedsen, 2011; Lauritsen, 2012; Tanner et al., 2019). To find novel pedagogical and technological solutions to prevent student attrition, we need a better understanding of student experiences of learning and studying processes. Understanding these phenomena both in general as well as in the local context also facilitates the development of degree programs and provides information to enhance faculty teaching competence (CDIO Initiative, 2021; Malmqvist et. al, 2019).

The challenge with student retention is present also at the University of Jyväskylä (JyU), where this study was conducted. The ratio between the new bachelor-level students and graduates from 2005 to 2020 was 72%, whereas in the field of IT, the ratio was 47%. According to the JyU student register data, approximately 63% of discontinued IT students over the past five years completed less than 30 ECTS (European Credit Transfer and Accumulation System) credits (corresponding to a half year's study progress goal), and 75% completed less than 60 ECTS credits. A research project connected to the educational development of the faculty was initiated upon the introduction of engineering as a new discipline at the university. The aim of the project is to provide research-based knowledge to support the enhancement of teaching, learning practices and learning environments among the IT department faculty. The project focuses especially on activities conducted during the first academic year in the engineering and computer science programs.

This study focuses on student experiences of learning and studying processes, especially as they relate to student self-efficacy and levels of study burnout, in the beginning of their studies. The study was conducted jointly within a new engineering B.Sc. and M.Sc. (technology) degree program in information and software engineering, and the first-year students of the B.Sc. and M.Sc. (computer science) degree programs in mathematical information technology and education technology at JyU. By developing new understandings of the emergence of self-experienced learning, its associations with IT student self-efficacy and the challenges of study burnout, this study will promote the sustainable and ethical development of higher education. This will assist in developing study programs in the IT domain.

## LITERATURE REVIEW

Student experiences of stress and heavy workload may have a negative impact on engagement in studies, academic achievement and study progression (Asikainen et al., 2022; Madigan & Curran 2021, Salmela-Aro et al., 2009). Thus, novel solutions are needed to prevent interrupted studies, lengthened graduation times and dropouts. The concept of school burnout can be divided into three components: exhaustion, cynicism and inadequacy. Exhaustion can be described as fatigue resulting from schoolwork and its demands. Loss of

feelings of meaningfulness and interest may manifest as a cynical attitude toward schoolwork, and low beliefs of one's own competence and achievements can cause feelings of inadequacy (Salmela-Aro et al., 2009). Burnout is often linked to exhaustion and high workload, but it is only one aspect for understanding burnout. Also, aspects of cynicism and inadequacy measure more broadly the motivational and psychological aspects of burnout (Leiter & Maslach, 2016).

Potential risk factors for burnout may include experienced high demands on studies, decreased interest, insufficient support, lack of learning and studying skills, low self-efficacy, surface approach to studies, mental health problems and uncertainty about future and career (see e.g. Asikainen et al., 2022; Neumann et al., 1990; Yan 2021). Asikainen et al. (2022) investigated the approaches of first-year university students to learning and study burnout by measuring these items with a HowULearn questionnaire and discovered that the burnout was positively correlated with the surface approach to studying. Understanding burnout as a phenomenon and its potential risk factors may enable better understanding of student engagement and attrition (Neumann et al., 1990).

Feelings of inadequacy are shown to be related to school burnout (see e.g. Salmela-Aro & Read, 2017). On the other hand, experiences of self-efficacy, used here to refer to student beliefs about their capabilities to perform in studies, are related to motivation, learning and academic performance (Richardson et al., 2012; Zimmerman, 2000*)*. Self-efficacy beliefs "influence how people think, feel, motivate themselves, and act" (Bandura, 1995, p. 2). Parpala et al. (2021) used the HowULearn questionnaire to investigate student learning profiles and self-efficacy beliefs in different disciplines and found out that deeply organized students had the highest self-efficacy levels in all disciplines. Self-efficacy beliefs are forward-looking and may predict studying behaviours and interests. Therefore, long-term tracking of student self-efficacy scores may be one tool for recognizing and anticipating challenges or gaps in learning (see e.g. Brennan & Hugo, 2017; Dinther et al., 2011; Luo et al., 2021; Zimmerman, 2000). Brennan and Hugo (2017) investigated experienced self-efficacy among engineering students and found out that self-efficacy was lower in technical areas than professional areas.

## RESEARCH QUESTIONS

This study focuses on student experiences of their learning and studying processes in the beginning of their studies. It aims to generate information about student experiences at a very early stage of their university studies to guide the development of a novel degree program. The research questions (RQs) are:

- RQ1: How do IT students experience study burnout at the beginning of their studies?
- RQ2: What kind of self-efficacy beliefs do IT students have at the beginning of their studies?
- RQ3: How are the self-efficacy beliefs of IT students associated with their levels of study burnout at the beginning of their studies?

## MATERIALS AND METHODS

### *Context and participants*

The study was conducted at the University of Jyväskylä. The university has hosted IT programs since 1967. In 2020, JyU introduced an engineering program into its portfolio. The new

curriculum is novel in the sense that it combines the studies in IT with mathematical and logical reasoning and a student chosen field in the humanities. The aim is for students to learn not only computer science and programming but also achieve a broader view on the reasons and needs for which IT is exploited. This is a rather ambitious goal, and consequently, it is important that students achieve experiences of insights to build motivation.

The first students in the combined B.Sc. and M.Sc. in information and software engineering commenced their studies in autumn 2021. The participants in this study were the first-year students from 1) the new engineering B.Sc. and M.Sc. (technology) degree program in information and software engineering and 2) the B.Sc. and M.Sc. (computer science) degree programs in mathematical information technology and education technology.

### *Data*

Student experiences were gathered through a HowULearn questionnaire (see details, Parpala & Linblom-Ylänne, 2012). The questionnaire was selected due to its wide use and validation in Finnish and in international contexts (see Parpala et al., 2021). The questionnaire will be repeated a total of four times throughout the bachelor-level studies of the students participants. The questionnaire was sent to the participants via email. To address our research questions, we used the student responses from the first part of the survey conducted after one month of studying. In total, 38 students answered the survey (response rate 36%), and the respondents were quite evenly distributed between the degree program in information and software engineering ($N$ = 20) and the degree programs in mathematical information technology and educational technology ($N$ = 18). The information and software engineering program has partly the same studies as the mathematical information technology and educational technology programs (e.g. a basic programming course), but its overall curricular structure differs. Because the program of information and software engineering is new to the University of Jyväskylä, and the programs of mathematical information technology and education technology have longer histories, both were included in the study to allow for possible comparison between these programs.

The survey has items that measure student study burnout and self-efficacy beliefs. Study burnout (RQ1) was measured with a part of HowULearn questionnaire that consists of a Study Burnout Inventory (SBI-9), originally based on the school burnout questionnaire by Salmela-Aro et al., 2009 (e.g. “I often have feelings of inadequacy in my studies”). Study Burnout Inventory measures three different dimensions of burnout with nine questions regarding the following: exhaustion (four items), inadequacy (two items) and cynicism (three items). The students responded to each item on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). Originally, the part of the HowULearn questionnaire measuring student self-efficacy beliefs (RQ2) has been modified from A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ; Parpala & Lindblom-Ylänne, 2012; Pintrich, P. R., 1991). Student self-efficacy was measured with a section of the HowULearn questionnaire including five questions about student beliefs regarding their future performance in studies (e.g. “I believe I will succeed in my studies”).

### *Analysis*

Differences between the information and software engineering program and the mathematical information technology and education technology programs were tested with a non-parametric Mann-Whitney U Test. Since we did not find significant differences between these programs, we performed the following analyses for the whole sample. To address RQ1, a sum variable

was formed based on all nine questions measuring study burnout. One sum variable was relied upon since the correlations within and between the subsets of the items (exhaustion, inadequacy, cynicism) were similar. To address RQ2, a sum variable was formed based on all five questions measuring self-efficacy beliefs. In addition to the descriptive statistics of the sum variables in RQs 1 and 2, the distributions, means, and standard deviations of the different items were considered separately. To address RQ3, we plotted the associations between the study burnout (RQ1) and self-efficacy beliefs (RQ2). The sum variables were used as measures of study burnout and self-efficacy beliefs and included a linear regression line to the plot, modelling the association between the two sum variables.

## RESULTS

### *Study burnout*

Regarding RQ1, some students seemed to experience study workload stress at a very early stage of their studies. The average of the sum variable measuring student study burnout was 2.5 (SD = 0.9). Every second respondent (50%) agreed they were often worried about studying in their free time. One-third of the respondents (34%) agreed with the claim "I often have feelings of inadequacy in my studies". Also, more than one-third (34%) felt overwhelmed with schoolwork. Over one-third (37%) of students agreed with the claim "I used to have higher expectations of my schoolwork than I do now". Almost one-fifth (18%) agreed that they were not sleeping well because of study issues. Student experiences of study burnout varied already at the beginning of their studies. Figure 1 illustrates the typical distribution of the responses concerning study burnout (Item 1 in Table A-1). All nine items measuring study burnout with their means and standard deviations are shown in Table A-1 in the Appendix.

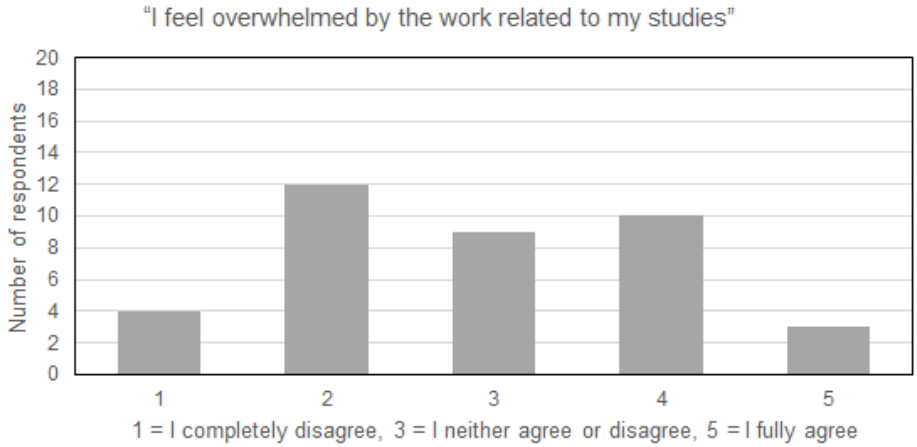


Figure 1. Student experiences regarding their levels of study burnout based on the item "I feel overwhelmed by the work related to my studies" (N = 38).

### *Self-efficacy*

In a seeming contradiction at the same time, when it comes to RQ2, the respondents had high self-efficacy beliefs. The average of the sum variable measuring student level of self-efficacy indicated high self-efficacy beliefs (mean = 3.9, SD = 0.8). For example, more than three-fourths (76%) agreed with the claim "I believe I will do well in my studies", and 71% agreed that they will understand the most difficult materials in their studies. Furthermore, 71 %

expected to do well in their studies. Almost four-fifths (79%) of students agreed with the claim "I am confident I can understand the basic concepts of my own study field". Student experiences of their self-efficacy varied less than the reported study burnout experiences. Figure 2 illustrates a typical distribution of the responses concerning self-efficacy beliefs (e.g. Item 1 in Table A-2). All five items measuring self-efficacy with their means and standard deviations are shown in Table A-2 in the Appendix.

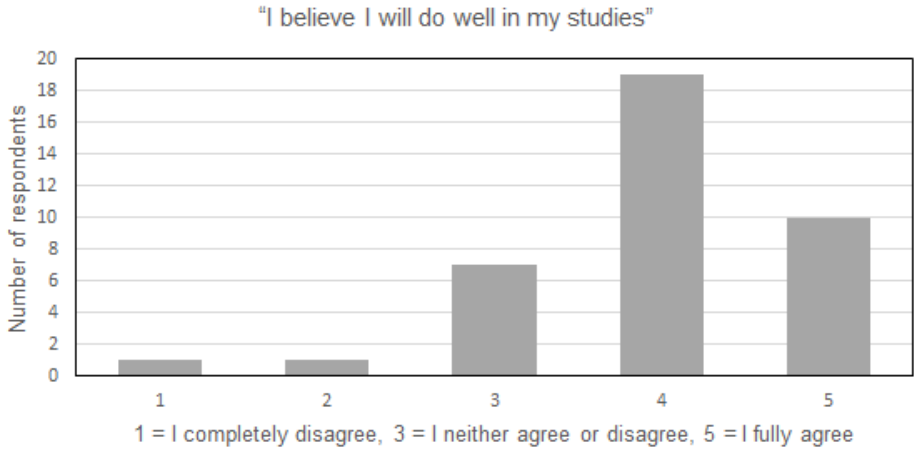


Figure 2. Student experiences regarding their self-efficacy based on the item "I believe I will do well in my studies" ($N$ = 38).

Figure 3 presents the averaged self-efficacy beliefs and levels of study burnout. The results reveal that most of the students experienced high self-efficacy beliefs (the averaged value 3.9 or more) with low experiences of study burnout (the averaged value 2.5 or less). Many students with higher levels of study burnout (the averaged value more than 2.5; see the dashed line in Figure 3) had lower self-efficacy beliefs (the averaged value less than 3.9; see the dashed line in Figure 3).

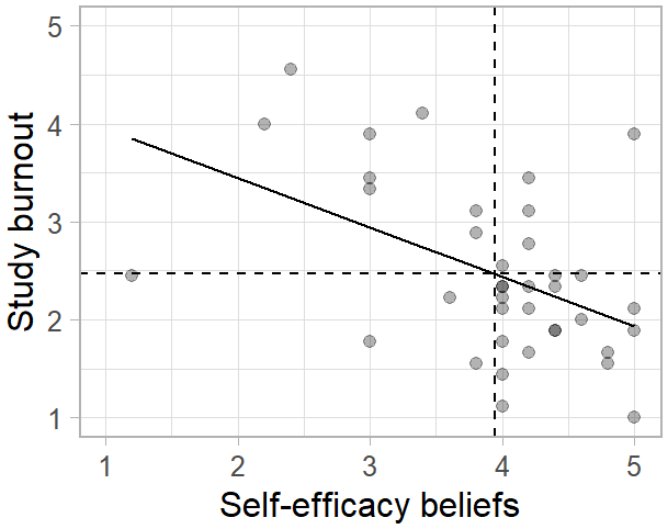


Figure 3. Student study burnout and self-efficacy beliefs so that each dot represents a student. The solid line has been fitted based on the linear regression model. The horizontal and vertical dashed lines present the mean of the study burnout and self-efficacy beliefs, respectively.

## DISCUSSION AND CONCLUSIONS

In the light of the results, a clear potential is that most of the students are experiencing high self-efficacy beliefs in the beginning of their studies (RQ2). High self-efficacy among IT students can empower individuals to become active agents in their studies, future working life and society (e.g. Zimmerman, 2000). When it comes to challenges, this study highlighted that some students experience quite high study burnout at the early stages of their bachelor-level programs (RQ1). Students with higher self-efficacy beliefs were, in several cases, experiencing lower levels of burnout (RQ3). This is aligned with previous research that shows that self-efficacy correlates negatively with burnout (e.g. Yan 2021). Feelings of inadequacy have been defined as one aspect of burnout (Salmela-Aro et al., 2009). However, burnout is a much broader phenomenon and also includes aspects of exhaustion and cynicism, and the reasons behind burnout may be even more multidimensional.

Feelings of burnout at such an early stage of studies could also indicate changes in learning practices upon transition from high school to university and the changing demands and challenges faced in studies. The current COVID-19 pandemic may also have had an impact on experienced levels of exhaustion and burnout at the beginning of the semester (e.g. Gonzalez-Ramirez et al., 2021). Since the number of respondents remained relatively small and the data was collected only from one cohort, conclusions on the results should be drawn with caution. Longitudinal data collection is needed to study the development of study burnout and self-efficacy beliefs during studies. The research team aims to repeat the questionnaire for the new cohort starting their studies autumn 2022 to better understand student experiences at the beginning and during their studies. More data would also enable us to further examine the associations between study burnout and self-efficacy beliefs.

Studying the development of student experiences of self-efficacy and burnout throughout the bachelor stage of this new degree program provides an understanding of the associations between their experiences over time. This knowledge, along with better recognition of possible risk factors for burnout, may support the development of novel pedagogical and technological solutions to provide timely guidance to students. Primetime learning is an example of a research-based instructional strategy that aims for enhanced student activity and social integration (Koskinen et al., 2018). Such new solutions and teaching methods that take student activity and social aspects of learning into account can pursue improved student well-being and, ultimately, decrease dropouts in the field of engineering.

## FINANCIAL SUPPORT ACKNOWLEDGEMENTS

This research was funded by the Academy of Finland [grant numbers 292466 and 318095, the Multidisciplinary Research on Learning and Teaching profiles I and II of University of Jyväskylä]. The support of the University of Jyväskylä is gratefully acknowledged.

## REFERENCES


Araque, F., Roldán, C., & Saguero, A. (2009). Factors influencing university drop out rates. C*omputers & Education*, 53, 563-574.

Asikainen, H., Nieminen, J.H., Häsä, J., & Katajavuori, N. (2022). University students' interest and burnout profiles and their relation to approaches to learning and achievement. *Learning and Individual Differences*, 93. DOI:https://doi.org/10.1016/j.lindif.2021.102105

CDIO Initiative (2021). *CDIO Standards 3.0*. Available online at: http://www.cdio.org/content/cdio-standards-30 (fetched November 28, 2021).

Bandura, A. (1995). Exercise of personal and collective efficacy in changing societies. In Bandura A. (Ed.) *Self-Efficacy in Changing Societies* (pp. 1-45). Cambridge : Cambridge University Press.

Bennedsen, J. (2011). Active Student Care – Lowring Student Dropout. *Proceedings of the 7th* International CDIO Conference. Copenhagen, Denmark: Technical University of Denmark.

Brennan, R.V., & Hugo, R.J. (2017). A self-efficacy survey for engineering graduate attributes assesment. *Proceedings of the 13th International CDIO Conference.* Calgary, Canada: University of Calgary.

Dinther van, M., Dochy, F., & Segers, M. (2011). Factors affecting students' self-efficacy in higher education. *Educational Research Review*, 6, 2, pp. 95-108. DOI:https://doi.org/10.1016/j.edurev.2010.10.003

French, B.F., Immekus, J.C., & Oakes, W.C. (2005). An Examination of Indicators of Engineering Students' Success and Persistence. Journal of Engineering Education, 94, 4, pp. 419-425.

Geisinger, B.N., & Raman, D.R. (2013). Why They Leave: Understanding Student Attrition from Engineering Majors. *International Journal of Engineering Education*, 29, 4, pp. 914-925.

Gonzalez-Ramirez, J., Mulqueen, K., Zealand, R., Silverstein, S., Reina, C., Bushell, S., & Ladda, S. (2021). Emergency Online Learning: College Students' Perceptions during the Covid-19 Crisis. *College Student Journal*, 55, 1, pp. 29–46.

Koskinen, P., Lämsä, J., Maunuksela, J., Hämäläinen, R., & Viiri, J. (2018). Primetime learning: collaborative and technology-enhanced studying with genuine teacher presence. *International Journal of STEM Education,* 5, 20. DOI:https://doi.org/10.1186/s40594-018-0113-8

Lauritsen, A. (2012). Bridging the Gap Between Theory and Praxis in Engineering Education. *Proceedings of the 8th International CDIO Conference*. Bisbane, Australia: Queensland University of Technology.

Leiter, M.P., & Maslach, C. (2016). Latent burnout profiles: A new approach to understanding the burnout experience. *Burnout Research,* 3, 4, pp. 89-100. DOI:https://doi.org/10.1016/j.burn.2016.09.001

Luo, T., So, W.W.M., Wan, Z.H. & Li, W.C. (2021). STEM stereotypes predict students' STEM career interest via self-efficacy and outcome expectations. *International Journal of STEM Education*, 8, 36. DOI:https://doi.org/10.1186/s40594-021-00295-y

Madigan, D.J., & Curran, T. (2021). Does Burnout Affect Academic Achievement? A Meta-Analysis of over 100,00 Students. *Educational Psychology Review*, 33, pp. 387-405. DOI: https://doi.org/10.1007/s10648-020-09533-1

Malmqvist, J., Knutson Wedel, M., Lundqvist, U., Edström, K., Rosén, A., Fruergaard Astrup, T., Vigild, M., Munkebo Hussman, P., Grom, A., Lyng, R., Gunnarsson, S., Leong-Wee Kwee Huay, H., & Kamp, A. (2019). Towards CDIO Standards 3,0. *Proceedings of the 15th CDIO Conference*, pp. 44-66. Aarhus, Denmark: Aarhus University.

Neumann,Y., Finaly-Neumann, E., & Reichel, A. (1990). Determinants and consequences of students' burnout in universities. *Journal of Higher Education*, 61, 1, pp. 20-31. DOI:https://doi.org/10.1080/00221546.1990.11775089

Parpala, A., & Lindblom-Ylänne, S. (2012). Using a research instrument for developing quality at the university. *Quality in Higher Education*, 18, 3, pp. 313–328.

Parpala, A., Mattsson, M., Herrmann, K.J., Bager-Elsborg, A., & Hailikari, T. (2021). Detecting the Variability in Student Learning in Different Disciplines—A Person-Oriented Approach. *Scandinavian Journal of Educational Research.* DOI:https://doi.org/10.1080/00313831.2021.1958256

Pintrich, P. R. (1991). A manual for the use of the Motivated Strategies for Learning Questionnaire (MSLQ). National Center for Research to Improve Postsecondary Teaching and Learning, Ann Arbor, MI: The University of Michigan.

Richardson, M., Abraham, C., Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, 138, 2, pp. 353–387. DOI:https://doi.org/10.1037/a0026838

Salmela-Aro, K., Kiuru, N., Leskinen, E., & Nurmi, J.-E. (2009). School Burnout Inventory (SBI): Reliability and validity. *European Journal of Psychological Assessment*, 25, 1, pp. 48–57. DOI: https://doi-org.ezproxy.jyu.fi/10.1027/1015-5759.25.1.48

Salmela-Aro, K., & Read, S. (2017). Study engagement and burnout profiles among Finnish higher education students. *Burnout Research,* 7, pp. 21-28. DOI:https://doi.org/10.1016/j.burn.2017.11.001

Schuman, L.J., Delaney, C., Wolfe, H., & Scalise, A. (1999). Engineering Attrition: Student Characteristics and Educational Initiatives. *Proceedings of ASEE Annual Conference '99*, Session 1430, Charlotte (NC), USA.

Tanner, D., Canty, D., & Power, J. (2019). Combined Strategies to Promote Active Learning and Retention. *Proceedings of the 15th International CDIO Conference*. Aarhus, Denmark: Aarhus University.

Tinto, V. (1975). Dropout from Higher Education: A Theoretical Sunthesis of Recent Research. *Review of Educational Research*, 45, 1, pp. 89-125.

UNESCO Institute for Statistics (2015). *International Standard Classification of Education: Fields of education and training 2013 (ISCED-F 2013) - Detailed Descriptions*. DOI:http://dx.doi.org/10.15220/978-92-9189-179-5-en

Vipunen (2021). *Vipunen – Education Statistics Finland*. Education Administrations Reporting Portal of the Ministry of Culture and Education and the Finnish National Agency for Education. Available online: https://vipunen.fi/en-gb/

Watson, C., & Li, F.W.B., (2014). Failure rates in introductory programming revisited. *Proceedings of the 2014 conference on Innovation & technology in computer science education (ITiCSE '14). Association for Computing Machinery.* New York, USA, pp. 39–44. DOI:https://doi.org/10.1145/2591708.2591749

Yan, S. (2021). The Effect of Learning Engagement on Learning Burnout of College Students: Taking Academic Self-efficacy as a Mediating Variable. *BCP Education & Psychology*, 3, pp. 213–224. https://doi.org/10.54691/bcpep.v3i.41

Zimmerman, B.J. (1990). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*, 25, 1, pp. 82-91. DOI:https://doi.org/10.1006/ceps.1999.1016

## BIOGRAPHICAL INFORMATION

***Raija Hämäläinen,*** a Full Professor (PhD), works in the field of technology-enhanced learning at the Center for Research for Learning and Teaching at the University of Jyväskylä, Finland. Belonging to the elite global top 3%, the JYU research centre is among the leading European research groups in learning and teaching. Recently, Raija and her research group were awarded the European Commission's VET Excellence Award. The driving force for their research is a rapidly changing world in which structural change is reshaping learning and professional development. The preconditions for designing future learning and professional development are the analysis and understanding of learning and interaction processes and their contextual adaptations. Specifically, Raija and her group seek to understand learning and professional development by investigating how learning and interaction processes occur and unfold over time with novel methods, such as eye-tracking, heartrate variability and prosodic analysis of voice.

***Miitta Järvinen*** is a Ph.D. student in the Department of Education at the University of Jyväskylä, Finland. She works in a research program focusing on higher engineering education. Her research deals with teacher-student interaction in technology-enhanced learning environments.

***Lauri Kettunen*** is a professor of computational sciences at the University of Jyväskylä, Finland. He is also the Vice Dean responsible for education among the faculty of information technology and has been in charge of the planning and implementation of the new engineering degree program at the university. His scientific research activities have focused on the intersecting field of technology, mathematics and IT.

***Joni Lämsä****,* PhD, works as a postdoctoral researcher in the Department of Education at the University of Jyväskylä, Finland. Lämsä's research interests include learning, teaching, and interaction in various technology-enhanced contexts. He has focused particularly on computer-supported collaborative learning, and on how to analyse and understand its temporal aspects, applying novel methodological approaches. Lämsä has actively participated in the research-based development of education in higher education contexts. For example, he has been involved in the implementation and development of the primetime learning model. The developers of the model received the Education Development Award for developing continuous assessment and making it visible to students, and for focussing on interaction in learning. Lämsä's recent publications include articles in Computers and Education, Educational Research Review, Frontline Learning Research, and Journal of Learning Analytics.

***Janne Roslöf*** is a professor of practice in engineering education at the University of Jyväskylä, Finland. He works as the Project Manager of the new information and software engineering degree program introduction. He holds a D.Sc. and M.Sc. in process systems engineering from the Åbo Akademi University and an M.A. in education science from the University of Turku, Finland. Also, he is an adjunct professor of software engineering education in the faculty of science and engineering at Åbo Akademi University, Finland.

***Corresponding author***

Miitta Järvinen
Faculty of Education and Psychology
University of Jyväskylä
Alvar Aallon katu 9
FI-40100 Jyväskylä, Finland
miitta.m.jarvinen@jyu.fi

## APPENDIX

Table A-1. The nine items that measured student study burnout with their means and standard deviations (SD).

| *Study burnout* | *Mean* | *SD* |
|---|---|---|
| 1. I feel overwhelmed by the work related to my studies. | 2,9 | 1,2 |
| 2. I feel a lack of study motivation and often think of giving up. | 2,0 | 1,2 |
| 3. I often have feelings of inadequacy in my studies. | 2,8 | 1,3 |
| 4. I often sleep badly because of matters related to my studies. | 2,1 | 1,1 |
| 5. I feel that I am losing interest in my studies. | 2,1 | 1,1 |
| 6. I'm continually wondering whether my studies have any meaning. | 2,2 | 1,3 |
| 7. I brood over matters related to my studies during my free time. | 3,2 | 1,3 |
| 8. I used to have higher expectations of my studies than I do now. | 2,9 | 1,4 |
| 9. The pressure of my studies causes me problems in my close relationships with others. | 1,9 | 1,1 |

Table A-2. The five items that measured student' self-efficacy beliefs with their means and standard deviations (SD).

| *Self-efficacy* | *Mean* | *SD* |
|---|---|---|
| 1. I believe I will do well in my studies. | 3,9 | 0,9 |
| 2. I'm certain I can understand the most difficult material in my studies. | 3,7 | 0,8 |
| 3. I'm confident I can understand the basic concepts of my own study field. | 4,3 | 0,9 |
| 4. I expect to do well in my studies. | 3,8 | 0,9 |
| 5. I'm certain I can learn well the skills required in my study field. | 3,9 | 0,9 |