A pilot study of self-regulated learning and self-determination in a collaborative, commercial off-the-shelf game

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ABSTRACT

The purpose of this pilot study was to assess the possibilities of a collaborative gamified context as a learning environment to improve university students' (n = 4) self-regulated learning skills, and in particular their use of metacognitive strategies. We also searched for moments of gameplay indicative of fulfillment or dissatisfaction of competence, autonomy, and relatedness; the basic psychological needs taken from the Self-Determination Theory. Furthermore, we examined whether the game would affect other self-related concepts; motivation for learning, measured by internalization of motivation and English language self-efficacy. Study data was collected using questionnaires, observations and transcriptions of the game sessions, and with post-game one-on-one interviews and a final joint group gathering interview, of which both were transcribed. Results indicate that, during gameplay, participant pairs used various metacognitive strategies; most prevalently summarization, representing information visually, switching between information sources and help-seeking. Neither the use of a specific metacognitive strategy or the frequency of strategy use in general predicted game scores in either pair. We identified 16 different subcategories of competence, autonomy, and relatedness, which we then fitted into existing theories of self-regulated learning. Motivation for playing internalized in one participant, and self-efficacy for English language use increased in two other participants. The participants also put forth progress in their note-taking and teamwork skills, while also taking into account their transfer from gameplay to school environments. Our results demonstrate the potential in games where this transfer is likely, setting a role for future research in further investigating the related phenomena.

Keywords: self-regulated learning, metacognition, self-determination, motivation, self-efficacy, game-based learning, collaborative board games

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ABSTRAKTI

Tämän tutkimuksen tavoitteena oli arvioida englanninkielisen ja yhteistyöhön perustuvan pelillisen kontekstin vaikutusta yliopisto-opiskelijoiden (n = 4) itsesäätelevän oppijuuden taitoihin, painotuksen ollessa metakognitiivissa strategioissa. Huomioimme pelihetket, jotka pitivät sisällään itsemääräytyvyysteorian mukaisten tarpeiden; kompetenssi, autonomia ja yhteenkuuluvuus, toteutumista tai estymistä. Lisäksi, tutkimme mahdollisia muutoksia pelikeskeisessä motivaatiossa sekä englannin kielen minäpystyvyydessä. Keräsimme dataa pelisessioista sekä yksilökohtaisista haastatteluista ja yhteisestä loppuhaastattelutapaamisesta kyselylomakkein, havainnoimalla sekä puhtaaksikirjoitettujen ääninauhoitteiden avulla. Tulokset osoittavat, että pareihin muodostetut pelaajat käyttivät lukuisia metakognitiivisia strategioita, joista yleisimpiä olivat tiivistäminen, informaation esittäminen visuorepresentatiivisesti, informaatiolähteiden vaihtaminen ja avun pyytäminen. Millään spesifillä metakognitiivisella strategialla tai sen käyttöasteella ei kuitenkaan ollut ennustusarvoa pelissä ansaittuihin pistemääriin. Kompetenssin, autonomian ja yhteenkuuluvuuden alakategorioita löysimme 16 erilaista, mitkä sovitimme itsesäätelevän oppijuuden jo olemassaoleviin teorioihin. Motivaatio pelaamiseen sisäistyi yhdellä osallistujalla ja englannin kieleen liittyvä minäpystyvyys kasvoi kahdella osallistujalla. Tutkimukseen osallistujat toivat lisäksi esiin kehitystä muistiinpanotaidoissaan ja tiimityöskentelyssään, huomioiden näiden mahdollisen siirtymävaikutuksen myös tavalliseen kouluympäristöön. Tuloksemme antavat suuntaa jatkotutkimukselle ja puoltavat tämän siirtymävaikutuksen sisältävien pelien lisäämistä kouluympäristöihin.

Avainsanat: itsesäätelevä oppijuus, metakognitio, itsemääräytyvyys, motivaatio, minäpystyvyys, peleihin perustuva oppiminen, yhteistyö-lautapelit

1. INTRODUCTION

For students, the leap from upper secondary or vocational schools to universities brings along new challenges, especially those regarding studying. Self-regulation, both on a psychological need level (Niemiec, Lynch, Vansteenkiste, Bernstein, Deci, & Ryan, 2006) and on a learning level (Kitsantas, Winsler, & Huie, 2008), is connected to positive outcomes in college education, such as academic satisfaction (Pintrich, 2000b; Zimmerman, 2008).

Self-regulated learning (SRL) is a comprehensive concept aimed at dissecting cognitive, affective, behavioral, and environmental factors of learning and their effects on learning outcomes (Pintrich, 2004; Zimmerman, 1989). However, most studies connecting a section of self-regulated learning to academic outcomes have only observed students' internal features or background, such as self-efficacy (e.g. Choi, 2005), socioeconomic status (e.g. Walpole, 2008), or study strategies (e.g. Marrs & Sigler, 2012). A lot less emphasis has been put on examining relevant features of the study environment on student self-regulated learning (see Perry, 1998 or Winne et al., 2006 for this type of research). Our study responds to this lack of emphasis by examining the effects an uncommon board game learning environment has on self-regulation of learning.

Regulating oneself effectively requires the environment to allow for experiences of satisfaction of basic psychological needs of competence, autonomy, and relatedness; three key features of the Self-Determination Theory (SDT) by Edward Deci and Richard Ryan (2000). People are naturally inclined to work for outcomes and in environments where these needs are present (Deci, Vallerand, Pelletier, & Ryan, 1991). A significant body of data has been found relating self-determination and the autonomous regulation of motivation it creates to positive educational outcomes (for a review of various studies, see Niemiec & Ryan, 2009). In addition, application of self-determination practices have been shown to improve achievement in many educational domains, for instance in physical education (Van den Berghe, Vansteenkiste, Cardon, Kirk, & Haerens, 2014) and in special education (Algozzine, Browder, Karvonen, Test, & Wood, 2001). Other than theoretical linkages (e.g. Nicholson, 2015; Seaborn & Fels, 2015), no studies have examined features affecting psychological need satisfaction in a context of gamification in educational settings, although experiences autonomy and competence have been studied in a game-based non-educational environment (Ryan, Rigby, & Przybylski, 2006). Because of its previously mentioned benefits on learning outcomes, need satisfaction

appears as a natural extension to self-regulation of learning when assessing the outcome related features of a gamified learning environment.

One of the most alluring modern pedagogical settings, a game-based learning environment for the purposes of education (e.g. Roehl, Reddy, & Shannon, 2013), has had growing amounts of evidence in the 21st century claiming its potential in visual selective attention (Green & Bavelier, 2003), motivation (e.g. Belanich, Sibley, & Orvis, 2004), enjoyment (Sweetser & Wyeth, 2005; Ryan et al., 2006), higher attitudinal and cognition outcomes (a meta-analysis by Vogel, Greenwood-Ericksen, Cannon-Bowers, & Bowers, 2006), self-efficacy, declarative and procedural knowledge (Sitzmann, 2011), retention (Sitzmann, 2011; Wouters, Van Nimwegen, Van Oostendorp, & Van Der Spek, 2013), and deep learning (e.g. Erhel & Janet, 2013; Wouters et al., 2013). However, there has also been contradictory results (O'Neil, Wainess, & Baker, 2005; Russell & Newton, 2008; Wouters et al., 2013), and requests for more hard evidence (e.g. Connolly, Stansfield, & Hainey, 2008; O'Neil, Wainess, & Baker, 2005). For more coverage on game-based learning, see the review by De Freitas (2006) or the recent meta-analysis by Clark, Tanner-Smith, & Killingsworth (2016), which states: "Overall, results indicated that digital games were associated with a 0.33 standard deviation improvement on cognitive competencies relative to non-game comparison conditions."

Our current pilot study aims to uncover the effects a game-based environment has on self-regulated learning. A subsection of SRL-theories; the use of metacognitive strategies, and how they relate to game performance in *Sherlock Holmes Consulting Detective* -board game is of particular interest to us in this study. Additionally, we study the characteristics of the board game that affect participants' self-determination as per the Self-Determination Theory by Deci & Ryan (2000). Finally, we examine whether playing *Sherlock Holmes Consulting Detective* -board game would change participants' perception of themselves as a learner in general and more precisely, their English self-efficacy.

1.1 Metacognition

The concept of metacognition was introduced by Flavell in 1979, and later reviewed for instance by Veenman, Van Hout-Wolters, and Afflerbach (2006) or by Schraw, Crippen, and Hartley (2006). Metacognition differs from cognition by having a meta-level, co-existing at the object-level of cognition (Nelson, 1996) with monitoring processes working the information

flow from the object-level to the meta-level. Also, metacognition generally refers to the self's higher order thinking; such as reasoning and learning e.g. strategies of goal setting, self-evaluation, and problem solving (e.g. McCombs, 2001). Metacognition is commonly divided into skill (planning ahead leading to related task performance) and the regulation of problem-solving and other learning activities; knowledge-related entities (Veenman, 2005; Veenman, Van Hout-Wolters, & Afflerbach, 2006). However, it is noteworthy that there remain a few issues about metacognition (Schraw, 1998; Veenman, 2012; Zimmerman, 1995), where a consensus hasn't been reached by the scientific community; e.g. general vs. domain-specific nature of metacognition and the consciousness of metacognition (Veenman, Van Hout-Wolters, & Afflerbach, 2006).

1.1.2 Collaborative learning and its impact on metacognition

Starting from around the change of century, collaborative learning has been suggested, with social interaction being a key mutual element between the initial varying conceptualizations of collaborative learning (Kreijns, Kirschner, & Jochems, 2003; see for review of the first wave of related studies). Collaborative learning is formed through social support and co-regulated learning (based on the socio-contextual view of learning, e.g. the zone of proximal development in Vygotsky, 1978), finally leading to overcoming socio-emotional and other types of challenges in joint problem solving with the use of strategies in socially shared regulation of learning, or SSRL (Hadwin, Järvelä, & Miller, 2011). The mentioned strategies are threefold: metacognition by an individual in order to regulate problem solving in a joint environment, visible yet not shared metacognition as an individual attempts to regulate the group process, and a shared metacognition as per group members forming collaborative strategies (Hurme, Merenluoto, Järvelä, 2009). In a case study research, Hurme, Merenluoto and Järvelä (2009) concluded that when in a problem-solving situation, a group's shared perception of the difficulty of the task in hand is affected by the reception of metacognitive messages; feelings of difficulty increasing with not receiving metacognitive messages or feedback on the person's suggestions, and feelings of difficulty decreasing with students receiving metacognitive messages. These results were in line with the previous study (Vauras, Iiskala, Kajamies, Kinnunen, & Lehtinen, 2003), where it was noticed that also the processes of the other group members should be monitored. Another illustrative example of the impact of social support comes from the hypermedia environment study of Azevedo & Cromley

(2004), which utilized a network of SRL-variables (Azevedo, Cromley, & Seibert, 2004; Azevedo, Guthrie, & Seibert, 2004), and a method of think-aloud -based self-reports to study the hypermedia environment's impact on scaffolding. Scaffolding refers to the cognitively ideal co-constructive tutor-interaction between the knowledgeable and novice (Chi, 1996); with features such as task-related simplification and interest-creation, and demonstrating the act while marking critical features and discrepancies (Wood, Bruner, & Ross, 1976). Their study demonstrated how undergraduate students who had pre-test training in SRL (n = 63), had developed statistically greater understanding of a complex science topic compared to the control group (n = 68). The training consisted of a script, in which was the phases and areas of SRL (Pintrich, 2000b), and of individual 30-minute training sessions with Roger Azevedo aiming to teach SRL based on the previous findings on the benefits of adaptive scaffolding and the hypermedia (Azevedo, Cromley, & Seibert, 2004; Azevedo, Guthrie, & Seibert, 2004).

These aforementioned concepts are crucial in our attempt to localize how would a curated list of metacognitive strategies (Azevedo & Cromley, 2004) appear in a co-operative board game, which represents the puzzles and deduction in detective work. Further interest derives from the fact that participants were grouped into pairs, which will allow us to compare the socially shared nature of problem solving in an equal pair (pair 2) and in pair 1, which was closer to scaffolding in that the other pair member came to the study from a background of current issues in studying.

1.2 Zimmerman's and Pintrich's theoretical models of self-regulated learning

After being distinguished from metacognition, self-regulated learning (SRL) models have undergone extensive research, resulting in a wide variety of different theoretical models (reviewed in Panadero, 2017). As self-regulation entails motivational, emotional, cognitive, metacognitive, and behavioral elements (Zimmerman, 2008), it is a comprehensive umbrella concept (Panadero, 2017). As our aim was on whether the gameplay of *Sherlock Holmes Consulting Detective* would be beneficial to participants, we required theoretical models of SRL to ground our findings on the self-related concepts of metacognition, self-determination, motivation, and self-efficacy. The (meta)cognitive aspects are pertinent to the SRL theories of Zimmerman (2009; 2013) and Pintrich (2000b; 2004), while the former model originates from the Bandura's views of self and self-efficacy (Bandura, 1977; Zimmerman, 1983), with the latter being more goal-driven, deriving from personal characteristics (Pintrich & de Groot,

1990). However, these models were also deemed to be sufficiently similar, as they both were listed as having equal amounts of emphasis on motivation, cognition, and emotion in Panadero's recent (2017) metareview. This similarity allows us to utilize both of these theoretical frameworks, when applicable.

The emphasis on metacognition was present already in Zimmerman's initial model of SRL, in its triadic form (Zimmerman, 1989). There SRL is defined as the degree of which students are metacognitively, behaviorally, and motivationally active in their learning by making the transactions from observation to self-regulation. This social cognitive pathway holds different levels of regulation, with each holding various implications to the sources of motivation, task conditions, and performance indices (Schunk & Zimmerman, 1997; Zimmerman, 2000). After integrating the motivational and metacognitive aspects of SRL, Zimmerman developed his current cyclical model of SRL, as seen in the Figure 1 (Zimmerman, 2000; Zimmerman, 2009). This cyclicality of SRL explains the reoccurring efforts of learning by qualitatively separating proactive learning from reactive learning. (Zimmerman, 2013)

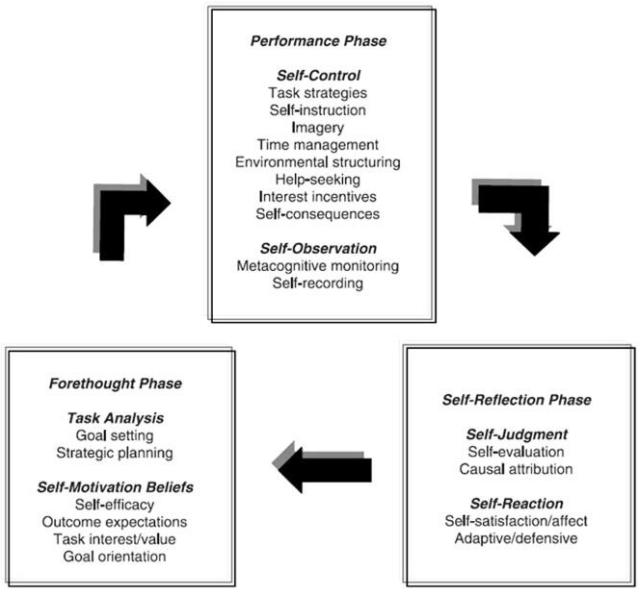


Figure 1. Cyclical model of SRL (Zimmerman, 2009)

In order for us to get a clearer look on the inherent motivational elements in gaming, it is first only fitting to present Pintrich's SRL model, as he was one of the pioneers in adding motivational factors to SRL (Pintrich & de Groot, 1990). Pintrich explicitly grouped the general assumptions of SRL models into four categories; the active and constructive nature of a learner, the potential for the learner to seize some control, the goal-driven comparisons to criterion or standards, and the assumption of SRL acting as a mediator between the learning

environment and the learner itself, with an impact to their performance or achievements (Pintrich, 2004). Pintrich also formulated a socio-cognitive model of SRL, consisting of four reciprocal phases of and areas for SRL, as seen in Table 1.

Table 1: Phases and areas of Self-Regulated Learning, (Pintrich, 2000b)

	Areas for regulation			
Phases	Cognition	Motivation/affect	Behavior	Context
1. Forethought, planning, and activation	Target goal setting	Goal orientation adoption	[Time and effort planning]	[Perceptions of task]
	Prior content knowledge activation	Efficacy judgments	[Planning for self-observations of behavior]	[Perceptions of context]
	Metacognitive knowledge activation	Ease of learning judgements (EOLs); perceptions of task difficulty		
		Task value activation		
		Interest activation		
2. Monitoring	Metacognitive awareness and monitoring of cognition (FOKs, JOLs)	Awareness and monitoring of motivation and affect	Awareness and monitoring of effort, time use, need for help	Monitoring changing task and context conditions
			Self-observation of behavior	
3. Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation of strategies for managing motivation and affect	Increase/decrease effort	Change or renegotiate task
			Persist, give up	Change or leave context
			Help-seeking behavior	
4. Reaction and reflection	Cognitive judgments	Affective reactions	Choice behavior	Evaluation of task
	Attributions	Attributions		Evaluation of context

The first column, cognition, requires the learner to be tactical and strategic in their regulative actions towards their goals and learning strategies, as the learner plans, monitors, and adapts or changes their cognition in relation to the problem, memory, thought process, and the reasoning behind the process. The column of motivation and affect is home to a variety of different motivational beliefs affecting learners' regulation; such as goal orientation (Dweck, 1986; Dweck & Leggett, 1988; Harackiewicz, Barron, & Elliot, 1998; Pintrich, 2000b), self-efficacy (Bandura, 1977; Zimmerman, 2000), internalization of motivation (Deci & Ryan, 2000), and the social scripts behind coping strategies in order to control negativity and anxiety (Boekaerts, 1998). The column describing overt action, the regulation of behavior, consists of effort control, time management, and help-seeking, with awareness playing part in constraining the behavior. Lastly, the regulation of context is especially important in learner-centered environments, where a learner is allowed autonomy in shaping the environment to match their needs and preferred learning methods, oftentimes having to take into account peers as well. (Pintrich, 2000b; Pintrich, 2004)

1.3 Self-determination

When examining the unique contributions non-formal educational contexts have on learning, we argue that the effects those contexts have on learners' self-determination is a potential mediating factor in learning. The Self-Determination Theory by Deci and Ryan (2000) is a theoretical framework concerning an interrelation between goals, motivation, and well-being. It posits that psychological well-being and effective functioning depend on the content and processes of goals and their achievement that promote fulfillment of innate psychological needs. Whereas other motivational theories, such as those of Dweck's goal orientation theory (1986) and Bandura's self-efficacy theory (1982), emphasize the importance of subjective abilities of self in instigating and maintaining behavior, Self-Determination Theory focuses more on the content of the goals themselves, along with the self-regulatory processes used to reach them.

In the epicenter of Self-Determination Theory (SDT) is the concept of needs. Deci and Ryan describe them as "innate psychological nutriments that are essential for ongoing psychological growth, integrity, and well-being" (Deci & Ryan, 2000. p. 229). These needs include those of competence, autonomy, and relatedness. In SDT, competence refers to a sense of challenge, feeling of mastery, and meaningful success in one's actions. Autonomy, in turn, represents a sense of choice, and free-willingness in doing activities. Additionally, autonomy involves being in control of one's own actions and attributing end states of behaviors to their self; and as such is closely related to the concept of locus of control by Julian Rotter (1966). Relatedness refers to a sense of belonging and connection with others. (Deci & Ryan, 2000)

According to Deci and Ryan's organismic-dialectical perspective of human functioning (2000), humans are naturally inclined towards well-being, self-growth, actualization of personal skills, and a unified sense of self. Furthermore, they posit that critical features of competence, autonomy, and relatedness need be present in their socio-cultural contexts and life histories in order to develop these natural tendencies of personal growth (Deci & Ryan, 2000). These features need not necessarily be identical in different cultural upbringings to exhibit similar levels of well-being. In fact, satisfaction of basic psychological needs is as much the result of the possibilities and limitations set by the surrounding environment as it is of the characteristics of the person himself (Ryan & Deci, 2000). If the features of personal surroundings offer little satisfaction for experiences of competence, autonomy, or relatedness, positive growth processes are replaced by other helpless, regressive, or isolative states (Deci & Ryan, 2000). These states, although functional in the sense that they minimize immediate

psychological damage to the persons using them, yield impractical and self-defeating forms of behavior and thoughts, such as shame, depression, and loneliness (Wei, Shaffer, Young, & Zakalik, 2005).

As briefly mentioned before, in SDT, need satisfaction is affected by the type of goals individuals set for themselves and by the form of regulation they use to strive for those goals (Ryan, Sheldon, Kasser, & Deci, 1996). From the standpoint of SDT, goals people set for themselves affect well-being in terms of how well they tap into the basic psychological needs of competence, autonomy, and relatedness (Ryan, Sheldon, Kasser, & Deci, 1996). Intrinsic aspirations, goals that aim for direct development of basic psychological needs, have been shown to improve facets of well-being such as self-esteem, life satisfaction, self-actualization, and positive affect (e.g. Niemiec, Ryan, & Deci 2009; Schmuck, Kasser, & Ryan 2000). Extrinsic aspirations refer to goals which attempt to improve self-worth in ways that are material, visible, and concrete; such as wealth, fame, or beauty (Ryan, Sheldon, Kasser, & Deci, 1996). These types of goals have been shown to increase harmful qualities of life such as anxiety, physical symptoms, and negative affect (e.g. Auerbach et al., 2011; Niemiec, Ryan, & Deci, 2009).

People differ not only in what they are motivated to do but also in how they are motivated to do it. SDT depicts motivation as a continuum between autonomous and controlled regulation (Deci & Ryan, 2000). An autonomously regulated person acts independent of outside persuasion or coercion, and is instead "fueled" by the performance itself: the joy, the curiosity, and the feeling of competence it creates (Ryan, Sheldon, Kasser, & Deci, 1996). Controlled regulation, on the other hand, is initiated and maintained in order to, for example, achieve rewards contingent of behavior or to avoid punishments and self-criticism (Ryan, Sheldon, Kasser & Deci, 1996).

1.3.1 Internalization of motivation

One of the core concepts of SDT is that of internalization. Internalization of motivation refers to the transformation of extrinsically motivated behaviors, usually those of larger societal and normative benefit that by themselves are not intrinsically motivating, into more self-determined behaviors (Ryan, Connell, & Deci, 1985). In an ideal process of internalization, the person fully integrates the value of a socially appreciated behavior or rule into his or her identity, which in turn causes the person to accept the regulation that follows it as coming from his or

her own self (Deci & Ryan, 2000). This transformation is a process that goes through different degrees of internalization and can come to a halt, leaving regulation to being partially controlled by external sources. These varying degrees of regulation are labelled in SDT as non-, external, introjected, identified, integrated, and intrinsic. (Deci & Ryan, 2000).

Non-regulation is analogous to amotivation. An amotivated person is unaware of the connection between his or her actions and their outcomes, and as such doesn't experience the need to regulate his or her behavior (Deci & Ryan, 2000). *External regulation* associates to the purest form of extrinsic motivation. Externally regulated people initiate and maintain behavior in order to achieve a reward or avoid a punishment independent from the behavior itself. In *introjected regulation* the contingent rewards and punishments of action have moved from the outside context into the person himself (Deci & Ryan, 2000). These intrapersonal outcomes of action are linked to self-esteem and self-worth. They manifest themselves as feelings of guilt and shame in failure and feelings of pride in success (Ryan, Connell, & Deci, 1985). Although the regulation comes from inside the person, introjected regulation hasn't yet fused into the structures that form the core identity and personal self (Deci & Ryan, 2000). *Identification* of regulation happens when a person identifies with the value of a behavior and accepts the regulation that follows it as his or her own (Deci & Ryan, 2000). *Integrated* regulation is the most self-determined type of extrinsic motivation. It concerns identifying with the value of a behavior and integrating it fully into the personal sense of self (Deci & Ryan, 2000). This integration happens by combining the behavioral value consistently, and without conflict with other important values and needs that make up a person's identity (Ryan & Deci, 2000). Actions and behaviors that are inherently pleasant and are performed without the need of additional reinforcement are intrinsically motivating and as such, are *intrinsically* regulated. Intrinsic regulation represents prototypical self-regulated and autonomous behavior (Ryan & Deci, 2000). Even the most internalized motivation does not typically become intrinsic, since they are still instrumental to some degree (Deci & Ryan, 2000).

What effects internalization of regulation has on learning? A literature review by Guay, Ratelle, and Chanal (2008) examined studies linking different types of motivation to different behavioral, cognitive, and emotional outcomes. For example, high autonomous motivation (internal, identified) was linked to fewer incidents of dropouts, increased academic achievement, improved retention, memorization, and more positive emotions in the classroom (Guay, Ratelle, & Chanal, 2008). In their more recent study, Vansteenkiste and colleagues (2010) used self-report measures to examine the role of autonomous and controlled types of regulation on academic performance goals in Belgian 10th to 12th grade students. They found

out that more autonomous regulation was associated with more cognitive processing, meta-cognitive processing, engagement in schoolwork, and less cheating. No associations with objective performance measured by exam results were found. Controlling regulation had an opposite effect to nearly all variables excluding cognitive processing. Controlling regulation was also negatively associated with objective performance at school (Vansteenkiste et al., 2010). From the results of these previous studies it follows that creating and maintaining an environment where learning can be seen as interesting, valuable and significant to immediate problems can lead to increased performance and learning. Our game-based learning environment aims at creating these exact conditions to foster deeper, more identifiable learning in our participants.

1.4 Self-efficacy

Self-efficacy, first introduced by Albert Bandura, is conceptualized as personal judgements of ability in organizing and performing goal-directed action (Bandura, 1977). The concept is different to that of outcome expectancy, which refers to person's beliefs that a given action leads to a specific end result (Bandura, 1977). The theory of self-efficacy posits that people engage actively in situations they consider to be in scope of their own abilities and avoid situations which they think surpass their resources and capabilities (Bandura, 1993). In addition, self-efficacy beliefs determine how much energy people expend in their efforts as well as the degree to which they persist, notwithstanding difficulties (Bandura, 1977).

Person's judgements of self-efficacy are founded on four different sources of information that reflect the person's abilities: enactive attainments, vicarious experiences, verbal persuasion and physiological states (Bandura, 1982). *Enactive attainments* have the most salient influence on self-efficacy, mainly because of the resulting feeling of mastery or the failure that the person experiences following his or her actions (Bandura, 1982). Personal successes improves and failures reduces future self-efficacy beliefs, and their effects are most pronounced during the beginning phases of action (Bandura, 1977). *Vicarious experiences* are the second most influential source of self-efficacy information (Bandura, 1977). By observing equally-skilled others accomplishing certain tasks, the observer receives information that if they perform and persist the same way, they too can succeed in similar situations (Bandura, 1982). If, however, the observer views the model as superior to him or herself in skill, the effects on self-efficacy by the outcome are likely to be dismissed as not concerning the self

(Zimmerman, 2000). *Verbal persuasion* can also affect efficacy expectations by encouraging the performer and thus signaling that they possess the skills and abilities to succeed (Bandura, 1977). Persuasion needs to be credible in order for it to have an effect on efficacy expectations (Zimmerman, 2000). Verbal persuasion may have little effect on self-efficacy per se, but by enabling the person to persist in their efforts and thus experience personal mastery, it can have a strong, mediative effect on self-efficacy (Bandura, 1982). Finally, people rely intermittently on their *physiological state* as a source of information about their performance (Bandura, 1977). Strong visceral stress reactions are known to impair performance, and because of this people feel more successful in absence of these physiological strains than when they are present (Bandura, 1982). At this stage it is important to know that the salience of different categories of self-efficacy information is distinct from actual cognitive appraisal of efficacy-relevant information (Bandura, 1977). Numerous different contextual, social, and attributional features of the environment transform the meaning people give to these forms of information; e.g., the impact of information on self-efficacy can be decreased if the person attributes failure or success to outside sources (Bandura, 1977).

The role of self-efficacy in academic success has been a subject of thorough inquiry. A meta-analysis by Multon, Brown, and Lent (1991) combined 38 similar studies examining the effects of self-efficacy on various performance measures, such as standardized tests, class performance, and basic skill tasks in elementary school children, high school students and college students. They found a combined effect size of .38 between measures of self-efficacy and aforementioned performance measures. This effect size was larger in high school and college students, which was assumed to be because of the longer school experience and thus more accurate self-efficacy appraisals (Multon, Brown, & Lent, 1991). Chemers, Hu, and Garcia (2001) studied the direct and mediating effects of self-efficacy on academic self-ratings and grade evaluations in a one-year follow-up study. The results show that in addition to self-efficacy itself, self-efficacy predicted academic performance through its effect on the positive subjective appraisal of coping skills. In other words, highly self-efficacious students viewed the academic pressures as more of a challenge than that of a threat, and thus fared better in their academic aspirations on their first year of college (Chemers, Hu, & Garcia, 2001).

In our study, we are specifically interested in the self-efficacy of foreign language learning. Raoofi, Tan, and Chan (2012), in their literature review, presented a body of research inspecting the effects of self-efficacy on second language learning. They concluded from their gathered studies that self-efficacy, like in other areas of education, is related to improved second language acquisition performance measured by either course grades,

reading skills, or listening skills (Raoofi, Tan, & Chan, 2012). Wong (2005) studied English learning strategies and language self-efficacy of Malaysian pre-service teachers. Results showed that high language self-efficacy participants used more learning strategies than participants with low language self-efficacy. Furthermore, interview data showed that high language self-efficacy participants reported trying to converse, write, and read more in English than their low language self-efficacy counterparts (Wong, 2005).

In Finland, much of the literature in university studies is in English. Our board game of interest, *Sherlock Holmes: Consulting Detective*, contains large amounts of English text from which participants can experience enactive attainments. The game is also played with a pair, which allows participants to witness vicarious experiences. The presence of these two strong sources of self-efficacy information makes changes in English self-efficacy possible in our study.

1.5 The motivational elements of gaming

Modern accounts of effective learning acknowledge that many variables contribute to academic performance. In recognition of this, Connolly, Stansfield, & Hainey (2008) proposed a broad model for the evaluation of games for learning and learning performances that includes motivational variables such as interest and effort, as well as learners' preferences, perceptions, and attitudes to games. Yee (2006b) studied MMORPG (Massively-Multiplayer Online Role-Playing Games) players, and their motivations to participate in those environments, which occurred on average for 22 hours per week. The results, based on a factor analysis from a survey population of 3 000 players, were used to form a typology of three main motivational components, with each having three or four subcomponents: Achievement (Advancement, Mechanics, Competition), Social (Socializing, Relationship, Teamwork), and Immersion (Discovery, Role-Playing, Customization, Escapism). Yee (2006a) also identified gender differences, in that females were more driven by the relationship and escapism subcomponents, whereas males tended to put more emphasis on the achievement factors, such as the Manipulation factor, which was later renamed into the competition-subcomponent (Yee, 2006b).

Games create purpose from a contest of powers; from an artificial conflict (Salen & Zimmerman, 2004), and include an outcome which can be identified: Games are responsive systems capable of prompt feedback, and function as frames that offer its players a chance to

step into a magic circle (Salen & Zimmerman, 2004); into something beyond real life, that exist in the game's own time and space. This sets up SDT as an apt framework to assess the underlying phenomena in gaming, as it can be applied both at the motivational level of a player "in character" and at the level of the player making choices (Ryan, Rigby, & Przybylski, 2006).

When studying games that have a social element, the relatedness aspect of SDT has significant relevance, and should be taken into account. Relatedness is ideally realized when adapting a socio-oriented learning approach; socio-constructivism or communal-constructivism, to games-based learning (Orr & McGuinness, 2014, in Connolly et al., 2014). Orr and McGuinness drew from earlier learning theories (e.g. Holmes and Gardner, 2006; Egenfeldt-Nielsen, 2006) in order to create a model where shifting the focus to a wider social context (beyond the contents of the game to dialogue, metacognition, and ultimately, towards the benefit of the learning community) leads to the development of a more intrinsic motivation from the extrinsic dimension of motivation. This bears resemblance to the aforementioned socially shared regulation of learning (Hadwin, Järvelä, & Miller, 2011) as a game puts players in action not only towards the game environment, but also while being intertwined with the actions of other people, in non-solitaire gaming. The interaction with other players can rely on the safety net formed by the magic circle, and the game's rules, that create a particular etiquette where it's easier to trust the game and other people (Salen & Zimmerman, 2004). The two distinct cases of social play are instances of transformative social play and metagaming. Transformative social play occurs e.g. when players start creating their own house rules, bending the existing actual rules based on the perceived needs of the social environment. As such, it is connected to the concept of metagames. A metagame is a shared understanding between the members of a group, and can often manifest itself in paratexts, beyond the actual game materials. In gaming literature, metagames have been divided into four categories (Garfield, 2000): The resources taken into a game, the resources and experiences taken away from a game, the space between gaming sessions (e.g. strategizing for the upcoming games or reading background history), and the events during a game that aren't directly related to the game itself yet still revolve around it.

Autonomy is most commonly referred to as agency in the game terminology, to indicate the range of possibilities and how much they require the player's active decision making. Tanenbaum and Tanenbaum (2009) went into detail about the concept of agency, arguing towards a more meaning-oriented apprehension. They concluded that instead of perceiving agency merely as choice or as freedom, it should be viewed as the expression of intent with the

receival of a satisfactory response, while being committed to the meaning of it. On a more of a micro level, Salen and Zimmerman (2004) theorized about an anatomy of choice, stating that an action leads to an outcome following these five sequential stages: 1. What led to this choice? 2. How the options are conveyed? 3. How did the player come up with the choice? 4. What's the result of the choice and how will it affect the player and impact the game's world going forward? 5. How the result of the choice is showcased to the player (often tied to the game's available materials).

Competence, the other factor besides autonomy theorized to enhance intrinsic motivation (Frederick & Ryan, 1995; Ryan & Deci, 2000), is essential in order to perceive any experience as meaningful and in positive regard. The satisfactory feel in games derives from a responsive user interface, which utilizes intuitive controls, and from a game system that continually adapts to the player's skill level, by giving just enough challenge (Przybylski, Rigby, & Ryan, 2010; Ryan & Deci, 2000) and performance feedback. The suitable combination of challenges and skill is also required for the experience of flow (Csikszentmihalyi, 1993). Furthermore, the processes of differentiation and integration are the two necessary elements for a person to recognize a challenge and eventually develop new skills from that activity. A person is more likely to orient towards being open-minded, experimental, curious, and willing to take risks, when the activity is in tune with their personality and interests. To master a skill, also endurance and discipline are required. This amount of requirements for optimal learning experiences wouldn't be obtainable without the autotelic nature of flow (having a purpose on its own right), as is evident on how it is described by absorption, clearness on goals and feedback, control, deep state of concentration, and enjoyment of the process itself (Csikszentmihalyi, 1975). The challenge in promoting flow through games in an educational environment is that the school infrastructure, class length, and the personnel (teachers, researchers) are likely to interfere or not able to connect with the flow experiences of an individual (see e.g. Van Eck, 2006; Ijsselsteijn, De Kort, Poels, Jurgelionis & Bellotti, 2007). Recently, with the rise of Extended Reality (such as Virtual and Augmented Realities) competence can be self-perceived in a very engaged and immersive way; utilized already in contexts which value simulation (Janßen, Tummel, Richert, & Isenhardt, 2016).

However, as explained by Deci and Ryan (2000), there are also some differences between the flow theory and SDT. Mainly, flow theory does not take into account the need for persons to feel autonomous while having the optimal experiences. Bassi and Delle Fave (2012)

made an effort to join the two perspectives of flow and SDT in a school setting. A noteworthy finding was the fact that competence, autonomy, and relatedness were mostly low for students who were experiencing optimally challenging activity, but the quality of the experience (measured with 8 variables, such as the levels of control and concentration) was high on the cases were SDT levels were high or moderate. Additionally, it has been previously claimed that flow is more prevalent in work, rather than in leisure settings (Csikszentmihalyi & LeFevre, 1989).

1.6 Gaming as a tool of learning

Educational games, or games with educational elements, propose a very alluring scenario where work, enjoyment, and motivation all come together to form an ideal setting for learning. McClarty et al. (2012) made the following claims on the benefits about the use of digital games in education: Games being built on sound learning principles, that they teach 21st century skills and personalized learning opportunities, and that they provide engagement in an environment for authentic evaluation. Some of these claims apply to non-educational games as well, to any game that can be considered "good". Gee (2005) listed 13 principles that ideally are corporated in games to foster learning: Identity (commitment and engagement), co-design (players can experience agency by interacting or by producing; e.g. transformative play and metagaming), customization (fitting to the individual learning needs), well-ordered problems (encouraging creativity), cycles of expertise through challenge and consolidation (hierarchy of progressively harder and intertwined problems), information that is immediately available on demand and "just in time" (when the players feel that they need the information, and when it can be actually used), situated meanings as action images (effective contextual and environmental cues, triggering imaginative reconstructions), pleasant frustration (deriving from just the right amount of challenge), system thinking (long reaching consequences with many implementations while being based on player decisions), manipulation and distributed knowledge (controlling characters and objects in order to reach a state of mind to learn), skills as strategies (based on exploration of goals from practicing with meaning), sandbox-like learning space (realistic, yet with room for risk taking and failure), and fish tanks (not requiring excessive competence before the ability to perform in the game). These elements about an ideal game appears to match what Sherlock Holmes Consulting Detective is able to throw at its

players based on our own experiences, our pilot game session with two colleagues, and its public reception from positive reviews and commercial success.

It has been demonstrated that commercial and recreational games can also be used to meet various educational goals in a school environment (see e.g. Pillay, 2002; Sandford, Ulicsak, Facer, & Rudd, 2006), known also with the term commercial off-the-shelf (COTS) game. In a majority of game related research, digital games has been the medium utilized, commonly abbreviated to DGBL (digital game-based learning). Papastergiou (2009) demonstrated that with the gaming approach, Computer Science students reached a more effective and motivational learning setting, when compared to non-gaming teaching methods. Numerous other examples are available from a literature review (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012), where it was similarly found that the most common learning outcomes were related to motivational/affective factor (in 33 papers) and to knowledge acquisition/content understanding factor (in 32 papers). However, the digital environments have had a vast array of technical problems restricting these studies and learning environments (e.g. Sandford et. al., 2006; Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2007). An alternative comes from utilizing a non-digital game to foster learning (Verzat, Byrne, & Alain, 2009; Ramani, Siegler, & Hitti, 2012). As such, we hypothesize that board games offer an appealing alternative, that on the surface would look to avoid the usability issues of digital games, while still being able to meet the majority of the benefits of DGBL. A compelling example of the impact of a board game setting (Wilde, 1993) showcased that ninth and tenth graders who were in the experimental group playing a game called Let's Get Rational, had their levels of irrationality (measured with Child and Adolescent Scale of Irrationality) and depression (measured with BDI) descend, when compared to the control group without the exposure for seven gaming sessions in a class period (in seven weeks). Although studies utilizing board games as their medium are scarce, one example has particular significance to our study frame. With a co-operative spaghetti bridge-building game, Verzat et al. (2009), aimed to highlight creativity in engineering students. Their findings underlined the fun and motivational factors in gaming, with primary noted benefits being related to teamwork and on the transition from the game's lessons to practical life. Further principles behind our thought process on using a game to study learning are related to the work by Foster, Esper, and Griswold (2013), who surveyed players of a real-time computer strategy game (Starcraft II), and found that the best-performing players engaged in extensive metacognitive activities, which was suggested to be required to enhance one's skills towards expertise. Based on these findings, they went on to monitor the responses on playing a game designed to develop

programming skills, where it seemed as though the need to perform better in the game brought forth instances of creative problem-solving, post-mortem.

1.7 Research questions

Before specifying the research questions, a few words about our thought processes behind the selection of these varied self-related concepts, and how this emphasis on the self relates to our hypotheses, should be in order. As Barbara McCombs explained in her 2001-article "Self-regulated learning and academic achievement: a phenomenological view"; when adopting a phenomenological stance towards the psychology of self, it posits the person-referenced understanding as the primary force to direct learning. Without going into extensive detail about the underlying epistemology and related historical accounts, this has several implications in the context of SRL and our study. First, it helps us to understand how self is the hypernym that groups the different self-systems together in the human's natural tendency towards learning with the goal of constructing a coherent and unified construct (the self), that will then be regulated and developed with this goal in mind (Deci & Ryan, 1991). Secondly, these general or domain-specific self-systems that direct our attributions are compatible with the models of intrinsic motivation and self-determination (Deci & Ryan, 1991). Such self-systems include structures such as different pathways to self-worth (e.g. athletic or likeability) (Harter, Waters, & Whitesell, 1998), as well as processes such as the processes commonly associated with metacognition, self-awareness, and self-evaluation (McCombs, 1986). Overall, these self-systems have been shown to be functional in the overall SRL-framework (e.g. Reeder, McCormick, & Esselman, 1987; DeSteno & Salovay, 1997). This allows us to fairly determine that a research frame that takes into account various self-systems; general and domain-specific (in-game and English) motivation and self-efficacy, metacognition, and self-determination, will be capable of highlighting key elements in the participant's self-regulative learning. We hypothesized that a learner-centered environment that playfully engages the inherent motivation and self-determination of the learner will cultivate these self-systems (McCombs, 2012). Furthermore, we decided to utilize the theoretical framework of Self-Determination Theory by Deci & Ryan (2000) in order to consider the forms in which *Sherlock Holmes Consulting Detective* as a study environment could affect to participants. We also hypothesized the linguistically (English) rich and gamified learning environment of the board game *Sherlock Holmes Consulting Detective* to challenge the learner to utilize a varied range of different

metacognitive strategies leading to changes in the participants' general and English-specific self-efficacy based on the game scores and self-judgements (Bandura, 1986; 1991). (McCombs, 2001)

Our research questions are as follows:

1. How does the game intervention utilizing *Sherlock Holmes Consulting Detective* affect participants self-regulated learning?

1.1 To what degree are metacognitive strategies present in *Sherlock Holmes Consulting Detective?* We studied the frequency of metacognitive strategies from the audio transcriptions and observations of the game sessions using content analysis, with pre-determined categories stemming from the coding key of Azevedo & Cromley (2004).

1.2 What are the specific patterns of metacognitive strategy use for the both pairs, and how do these patterns relate to game performance? We examined this by comparing the amount of different metacognitive strategies used in session with the corresponding score the pairs received in those sessions.

1.3 How do the participants experience *Sherlock Holmes Consulting Detective* affecting their self-regulation of learning? Final game session interviews, along with the final group gathering were used to assess whether participants perceived the board game influencing their regulation of learning. Changes in self-regulated learning was also examined using the self-evaluation subscale from Self-regulated Learning Assessment (A-SRL. Magno, 2010) and The Motivated Strategies for Learning Questionnaire (MSLQ. Pintrich, 1991), that assesses different aspects of self-regulated learning (planning, monitoring, and regulating).

2. Does the game sessions of *Sherlock Holmes Consulting Detective* promote satisfaction of the basic psychological needs (competence, autonomy, and relatedness) as per the Self-Determination Theory (Deci & Ryan, 2000)?

2.1 How do the basic psychological needs of competence, autonomy, and relatedness (Deci & Ryan, 2000) present themselves during game sessions and the last game session interview? By using transcripted audio recordings of the game sessions and the last game session interview, we looked for moments of gameplay that reflected the presence of competence, autonomy, and relatedness.

2.2 How well does the *Sherlock Holmes Consulting Detective* enable the participants to experience self-determination? We examined this question by using the Player Experience

of Need Satisfaction -Scale (PENS. Ryan, Rigby, & Przybylski, 2006), which assesses various features of the played game that promote self-determination.

3. How does the game intervention effect participants motivation for learning?

3.1 Does the game sessions affect the participants' scores on a scale measuring internalization of motivation during game sessions? Intrinsic motivation for the game was examined using the Value and Usefulness-subscale of the Intrinsic Motivation Inventory (IMI. Ryan, 1982).

3.2 Does the English language self-efficacy change during game sessions? Changes in English language self-efficacy were measured using subscales of The Motivated Strategies for Learning Questionnaire (MSLQ. Pintrich, 1991) and Patterns of Adaptive Learning Scale (PALS. Midgley et al., 2000) that assess self-efficacy in understanding the language present in the game.

3.3 What kind of an effect will the game experiences have on the participants' general self-efficacy as learners? We used transcripted data from the final joint gathering in which all participants reflected on their perceived changes in their general self-efficacy as a learner.

2. METHODS

2.1 Procedure

The general structure of our study, along with questionnaires distributed in each gaming session, is presented in Figure 2.

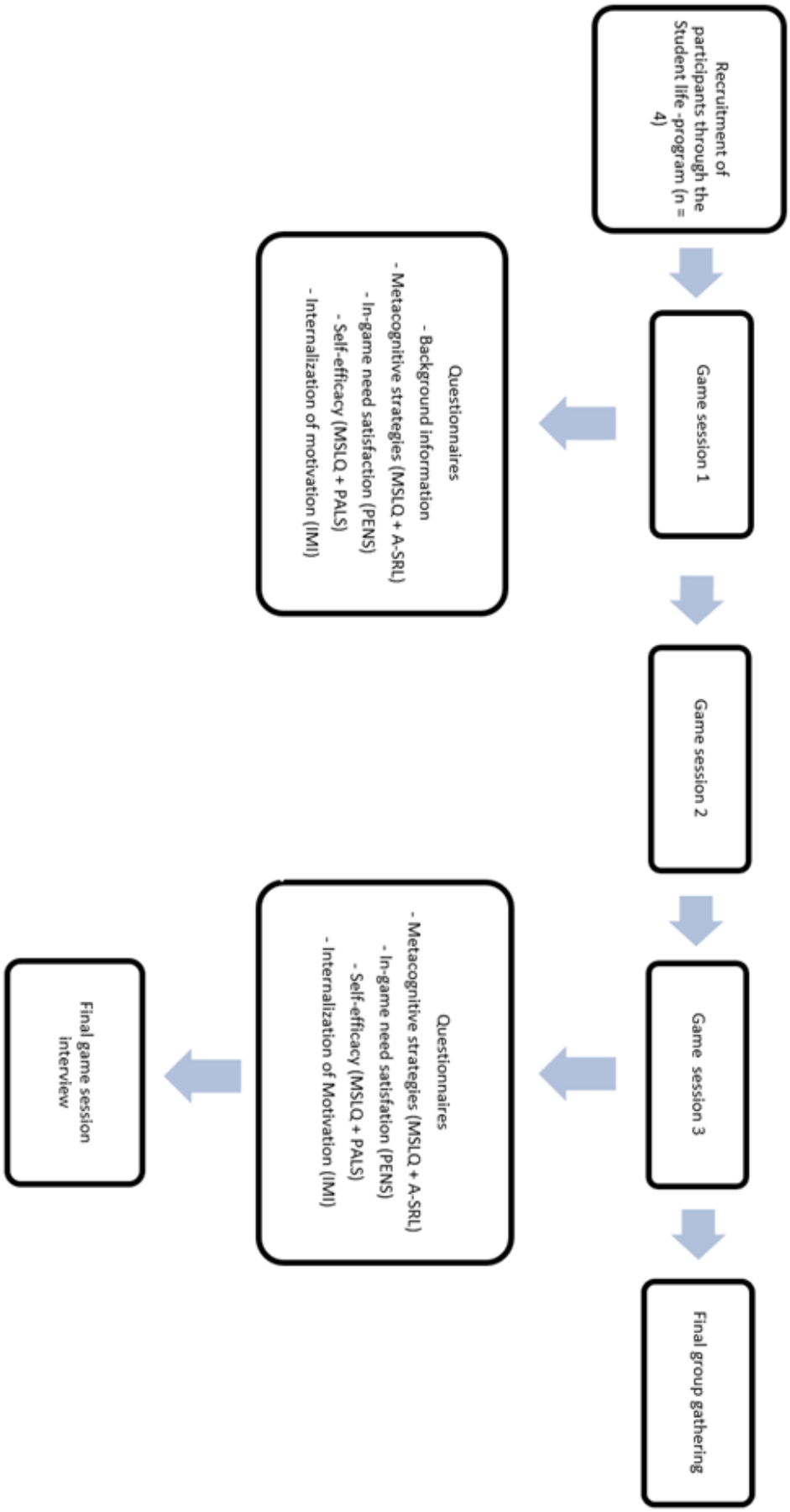


Figure 2. The general structure of our current study

2.1.1 Participants

Participants of this study were recruited through an ongoing Student Life -program at the University of Jyväskylä. Student Life aims to cultivate practices and projects that improve student wellbeing and success. Target population was selected this way in order to examine the potential of *Sherlock Holmes Consulting Detective* board game to improve self-regulated learning skills and English language self-efficacy of students specifically facing these issues.

Contact was first made via emails to students that took part in the Student Life -program during the semester of 2016-2017. The email included a brief outline of the study and the board game in question, along with instructions on how to participate in the study. Out of the possible five students, two (40%) expressed their willingness to participate in our study. In order to increase our sample, we contacted students attending the Student Life program in fall 2017. We met these students face-to-face and briefly explained the outline of our study and the board game in question, along with instructions on how to participate in the study. Out of these 39 that took part in the project in fall 2017, two expressed their willingness to participate. Thus, the final sample consisted of four participants out of the possible total of 44. A paper form of consent to participate in the study was filled by all four participants. The participants were randomized into two pairs. Both pairs had one female and one male participant, listed here under the abbreviations of N for female and M for male (T refers to a researcher). Thus, the participants from the first pair are N1 and M1, with the participants from the second pair being N2 and M2. The age of the participants varied from 23 to 28, with the average age being 26. The unavailability of comparable data prevented us from comparing the study participants' background information to other participants of the Student Life program or to other students of the University of Jyväskylä.

2.1.2 *Sherlock Holmes: Consulting Detective* -board game

The authors chose a board game called *Sherlock Holmes Consulting Detective: Jack the Ripper & West End Adventures* (2017) for this study, for a few prominent reasons: First, it is a contemporary and a modern leisure game, but one with a long pedigree as a classic in board gaming; as the original game was published in 1981 under the name of *Sherlock Holmes Consulting Detective: The Thames Murders & Other Cases*. It was a point of interest to study

the educational potential of a COTS game that is simultaneously pleasurable enough to have mass-market appeal, yet still being intellectually demanding. Secondly, the game features an extensive list of game mechanics and elements that we hypothesized to be captivating or beneficial to its players: Cooperation, leadership, storytelling, puzzle-likeness, being based in classic literature and historical accounts, deduction, extensive amounts of text in English, and note-taking. Some of these elements were considered to have common ground with academic skills. The game offers players an interactive sandbox as their environment to freely use the game components at hand to best solve the case. In addition, *Sherlock Holmes Consulting Detective* is not a board game in the traditional sense, since it lacks any usual board game components in cards, dice, miniatures, meeples, or cubes; and instead it might be more aptly described as a thematic storytelling activity, lasting for as long as players feel the need to investigate new locations. This is usually at least two hours, but the time is somewhat kept in proportion by the fact that players score less points for every location they visit. Players' scores are also altered based on how well they will be able to answer to a handful of primary questions mostly related to the why's and how's of the main crime and to a handful of secondary questions regarding other criminal activity. The questions will be revealed only when players have seized visiting new locations. An excellent game score is anything close to 100, as that is always the reference score by the story's expert detective, Sherlock Holmes himself.

The game puts 1 to up to 8 players in the shoes of fictional characters, known as Baker Street Irregulars, assisting in solving cases of murder and mystery. Players' cognitive, reading comprehension, and teamwork skills are put to test as they utilize a map of London (divided into five districts with reference numbers), a London directory (consisting of the addresses of the citizens and businesses of London), a case-specific book (starting with an introductory story and initial clues), and the day's newspapers (with potential clues relating to the case). The cases will each present novel challenges to the players with its host of novel narrative elements in the casebook and the day's fresh newspapers. A written script about the game instructions used to explain the game for the participants, and footage of the game components can be found in the Appendix A.

2.1.3 Game sessions and data collection

After the sample size was determined, emails were sent to all four participants. The email included a hyperlink to a web-based scheduling site where the participants could mark suitable

dates and times for their first game session. Participants were grouped into pairs based on their preferred times and dates for the first game session, which represents a slight deviation from the otherwise randomized pairing process. As the participants did not know each upfront, this was deemed to not impact the sample.

The game intervention consisted of three game sessions. In each session, one of the researchers was present. Background and questionnaire data were collected during the first and third game session and interviews were also administered in the last game session. Before the first game sessions, participants were informed that the maximum playing time would be 4 hours. The game sessions took between 195 to 237 minutes to finish; second sessions being the most brief in both pairs and with the third and final sessions being the lengthiest. Participants, co-operating together as a pair, attempted to solve a single murder case scenario in each of the three game sessions. Before the first session, the researcher introduced the game and its components, and gave a basic rules explanation for the participants (following a rough structure present in Appendix A) followed by playing an audio recording of the respective introductory text using a mobile device and a publically available application. Researchers playtested each scenario to evaluate whether they were too challenging for non-native speakers of English.

During gameplay one of the researchers was present in the room where the participants played. Researchers didn't take part in solving the case or helping with clues, but assisted the players when they were confused with the rules of the game. Researchers observed the participants during gameplay using a predetermined classification of metacognitive behavior applied from Azevedo & Cromley (2004). This observation was to facilitate coding for metacognitive strategies as well as to add a few frequencies of the nonverbal metacognition, when clearly visible. At the end of the first and second game session, researcher and the participants agreed on a date and time of the next game session. Time between game sessions varied between 2 and 28 days, with the mean time being approximately 10 days. The game sessions were intended to be organized once every week, but due to participants' other plans and Christmas holidays, minor alterations to scheduling had to be made.

After the last game session, participants were interviewed privately about their experiences regarding game sessions. We specifically asked about self-efficacy beliefs concerning English language skills, presence of the basic psychological needs, and changes in metacognitive strategies. The semi-structured interview lasted for approximately 10-15 minutes for each participant. The interview frame constructed by the researchers is presented in Appendix B.

Excluding the introduction to the cases and the filling out of questionnaires, each game session was recorded on an audio recorder. Audio records were then transcribed on a word level. From the transcribed game session data, both researchers then proceeded to coding by using the qualitative data analysis software tool ATLAS.ti 7 (Friese, 2013). There, both researchers privately highlighted phrases, sentences, and moments indicative of both metacognitive strategies as per the metacognition coding key (from Azevedo & Cromley, 2004), and of the basic psychological needs as per the Self-Determination Theory by Deci & Ryan (2000). After the initial coding the two researchers compared their notes and in the case of conflicting codification researchers discussed together on how to code the entry in question.

After both pairs had had their game sessions, a final group gathering was arranged. The gathering took 70 minutes to complete and was audio-recorded and transcribed. During the gathering researchers asked questions regarding the game experience as a whole, as well as more specific questions covering participants' sense of change in metacognitive strategies and self-regulated learning during game sessions by using a carefully produced open-ended question frame. This question frame posed to the participants in the final group gathering is presented in appendix C. At the end of the gathering, movie tickets were given to all participants as a reward and the *Sherlock Holmes Consulting Detective* -game was raffled to one of the participants.

2.2 Measures and data analysis

2.2.1 Metacognitive strategies and self-regulated learning

After each game session, players scored their success in solving the mystery by using a scoring sheet found in each scenario. These scores were used as the dependant measure in research question 1, where we examined whether the changes in metacognitive strategies would lead to changes in the game score. Scenario scoring took into account both the amount of knowledge players managed to gather during a game session as well as the efficiency of the pair by reducing points if the players searched for unnecessary clues.

From the transcribed game session data, both researchers coded phrases, sentences, and moments indicative of metacognitive strategies as per the metacognition coding key (from Azevedo & Cromley, 2004). The adapted metacognition coding key was initially tested and revised on a pilot gaming session with two colleagues. Observation was done with only one

researcher present, so its impact was more of a supportive one to the transcriptions by providing timelines of key in-game events, a few observations of nonverbal metacognition, and some miscellaneous information. The few observations of nonverbal metacognition were then reviewed by the other researcher, and when applicable, were added to the coded metacognitive strategies which were analysed using content analysis based on the transcriptions.

Content analysis can be performed in two ways, inductive or deductive, depending on whether previous theories are being used as a basis for further categorizations (Elo & Kyngäs, 2008). For our purposes, we chose deductive content analysis so that the categories of interest would match with those of our observation key used in game sessions. The categorization matrix used in this study is structured, meaning that only excerpts fitting in to one of our categories are quantified and reported. In the case of conflicting codification, researchers discussed together on how to code the entry in question. Categories of metacognitive strategies were adopted and modified from an earlier study conducted by Azevedo and Cromley (2004), which examined self-regulated learning in a computer hypermedia environment. From this study, researchers selected the categories of metacognitive strategies that were both possible to code reliably by audio recording and to most likely to arise during gameplay. Apart from the practical reasons, they were chosen as the focus for being the most correlated SRL-variables to high-jumpers (gains of conceptual understanding) and to minimal shifts in conceptual understanding; low-jumpers (Azevedo, Guthrie, & Seibert, 2004). Out of these strategies, one of the subcategories of elaboration of information; summarization (also listed in Azevedo & Cromley, 2004) was formed as its own metacognitive strategy to better suit the context of gaming. In addition, metagaming, which was originally thought to exist as a subcategory of hypermedia, was considered too different, yet important enough to warrant its place as its own strategy, and by also being a well known term in gaming (Garfield, 2000). The final categorization matrix is presented in Table 2, where also the interrater agreement ratings are shown. After the first round of coding, researchers decided to drop categories of argumentation and elaboration because of them both being intercorrelated and higher in the conceptual hierarchy to other metacognitive categories; such as to summarization, perception of saturation, and metagaming. When additionally, there were noticeable differences in the comprehension of categories between researchers, it led us to conduct a second round of coding. After this, the researchers calculated the final frequencies and interrater agreements for both pairs in each session. Interrater agreement varied between different metacognitive strategies in question, from 24% in metagaming to 62% in summarization. The frequency of metacognitive strategies

Table 2. Coding key for behavior; reflecting the use of metacognitive and other SRL strategies, listed here by their order of frequencies. Refer to Table 1 for complete description on areas and phases of SRL.

Strategy type	Classification (area, phase of regulation)	Content	Example	IRR
Summarization	Cognitive, Control	Condensing what was just read, heard, or inspected	e.g. "She mentioned that he has a debt to the bank, and is now feeling desperate."	62 %
Visual representation	Cognitive, Control	Representing information using physical tools or one's own body	e.g. directing the gaming partner's focus by pointing at something	49 %
Changing information source	Cognitive, Control	Changing a source of information to another one	e.g. putting the scenario book down and picking up the scenario newspaper	34 %
Asking for help	Behavioral, Control	Consulting a game partner or the researcher in problem situations	e.g. "Can we go back to a place we visited without it counting as a clue?"	48 %
Metagaming	Cognitive, all phases	Anticipating or reflecting parts of the game from a perspective beyond the game	e.g. inducting that certain game-related decisions get rewarded or punished	24 %
Perception of saturation	Cognitive, Monitoring	Consulting a game partner or the researcher in problem situations	e.g. "Can we go back to a place we visited without it counting as a clue?"	48 %
Time management	Behavioral, Monitoring/ Control	Taking into account the remaining time to solve the case	e.g. "Doing so would take too much time."	43 %
Hypermedia	Cognitive, Control	Using outside sources of information to advance in the game	e.g. using a smartphone app to convert feet to meters	37 %

in each session were controlled by the time spent in those sessions. Pairs were then compared with each other using these time-controlled strategy frequencies.

From the final group gathering, we searched for themes pertaining to participants' perceived changes in self-regulative strategies during game sessions, as well as their potential transfer to academia. The most salient themes arising from this gathering were reported along with descriptive extracts.

Self-regulated learning strategies were measured using subsections of two questionnaires. The first one is the metacognitive self-regulation -scale of the Motivated Strategies for Learning Questionnaire (MSLQ. Pintrich, 1991) that assesses person's use of different metacognitive strategies in a study environment (e.g. "Yritän vaihtaa opiskelutapojani kohdatakseni oppimistilanteen vaatimukset ja ohjaajan opetustyylin"; "Kun olen ymmälläni luetusta kurssimateriaalista, palaan tähän asiaan ja pyrin selvittämään sen"). The second questionnaire was modified from The Academic Self-Regulation Scale (A-SRL. Magno, 2010). In particular, the self-evaluation -subscale of A-SRL was used for our study. This subscale inquires monitoring and the feedback receiving strategies the person uses in his or her studies (e.g. "Arvioin saavutuksiani jokaisen oppimistilanteen päätteeksi"; "Huomioin kehitysaskeleeni asioissa, joita teen"). The self-evaluation sub-scale of A-SRL shows high internal consistency and the scale as a whole shows convergent validity with two similar measures of self-regulated learning strategies, MSLQ and LASSI (Magno, 2011). From both questionnaires, out of the 12 original items, two items of the scale were removed due to their untranslatability for our study. MSLQ used originally a 7-point Likert scale that we transformed into a 4-point Likert scale in order to make it compatible with A-SRL. These two subsections were then combined and their aggregate score was used to make a 20-item scale assessing self-regulated learning skills in everyday practice. All questions and statements in the questionnaires used in this study were translated into Finnish. Some questions were modified in order to better fit into the performance domains of interest to us. Due to the small sample size, no statistic tests were made for the questionnaire data in this study. Instead, questionnaire data was analysed purely on a descriptive level.

2.2.2 The Presence of self-determination

From the transcribed game session data, both researchers separately highlighted phrases, sentences, and moments indicative of basic psychological needs (competence, autonomy, and

relatedness) as per the Self-Determination Theory of Deci & Ryan (2000). Next, researchers searched privately for categories which could encompass our initial codes using thematic analysis as described by Braun & Clarke (2006). Thematic analysis is a qualitative method used to recognize, categorize, and combine recurring features in the research data (Braun & Clarke, 2006). The thematic analysis produced by the researchers was different from the recommendations of Braun & Clarke (2006) in that the main categories of our analysis were theory driven while the sub-categories in them were data-driven. After the first round of code reviewing, 27 categories were found in total when combining the categories from both researchers. Following this, researchers discussed their discovered sub-categories together. Similar categories of the presence of psychological needs were combined into larger categories until no further categories could be combined. Categories in which codes seemed too heterogeneous or few were removed. And where applicable, their codes were recategorized into other categories. The seven removed categories were the following, listed here in their alphabetical order: Confidence, Copping out, Freedom of Choice, Hindsight, Task Assigning, Chain of Inferences, and Time Pressure.

Apart from the coding of transcribed game sessions, self-determination present in-game was measured using Player Experience of Need Satisfaction -scale (PENS. Ryan et al., 2006). PENS assesses the presence of basic psychological needs as theorized by Deci & Ryan (2000). In addition to these basic psychological needs, PENS measures in-game presence. Presence refers to a feeling of being *in* the game and being a part of the game world instead of controlling the game from an outside perspective, without a sense of immersion (Ryan et al., 2006). PENS also features a measure of intuitiveness of controls. Intuitive controls in PENS concern how well the controls make sense, are masterable, and how well they support immersion in-game. Intuitive controls are seen to increase the feeling of control, competence, and freedom in the game (Ryan et al., 2006). PENS has been shown to possess acceptable internal consistency in previous studies (Lafrenière, Verner-Filion, & Vallerand, 2012; Ryan et al., 2006). Since our game of interest is not a video game, items from the intuitive controls -subscale were modified to assess the intuitiveness of game components and materials instead of virtual controls and interface. Subscales of PENS thus include in-game autonomy (e.g. ”Tämä peli tarjoaa minulle mielekkäitä vaihtoehtoja ja valintoja”), competence (e.g. “Koen olevani pätevä tässä pelissä”), relatedness (e.g. “En koe läheisyyttä pariini”), presence (e.g. “Kun pelaan tätä peliä, koen kuin olisin osa sen tarinaa”), and intuitive controls (e.g. “Pelimateriaalien käyttämisen oppiminen oli helppoa”). All subscales contained three items, excluding presence which had nine items. Four items from the presence-subscale were removed for being unfit for use in a board game

setting. Hence, the final scale contained 17 items. Questions from PENS were answered in a 7-point Likert scale. Because of differences in the number of items in subscales, mean score for each subscale was calculated and these mean scores were added together to form the final score on this questionnaire.

2.2.3 Motivation for learning

As mentioned in research question 3, we examined changes in general motivation for learning by measuring the changes in internalization of motivation and English language self-efficacy for playing *Sherlock Holmes Consulting Detective.* In addition, we interviewed the participants about their subjective changes in their view of themselves as students and attitudes towards learning.

Internalization of motivation was measured in our study using the Intrinsic Motivation Inventory (IMI. Deci & Ryan, 2003). For the purposes of our study, we administered both the interest/enjoyment and value/usefulness -scales of the inventory, but only used the latter scale for its relevance for our research question. The value/usefulness -subscale measures the internalization of motivation (Intrinsic Motivation Inventory [IMI]. 2017, December 4) by questions such as "Uskon, että tästä pelistä voi olla jotakin arvoa minulle" and "Ajattelen, että tämän pelin pelaaminen on tärkeää". A study has shown this IMI -subscale to possess good internal consistency and supported the scale's five-factor hierarchical model (McAuley, Duncan, & Tammen, 1989). A single question from the value/usefulness -subscale was duplicated and its point of query was modified in order to get information on both academic and English language motivation. 15 items (7 from interest/enjoyment + 8 from value/usefulness) were thus selected to be used in our inventory, from which eight were used to assess internalization of motivation. Questions from IMI were answered using a 7-point Likert scale (1 = not true at all, 7 = very true).

We measured self-efficacy in English language using the equivalent scales from both the MSLQ and Patterns of Adaptive Learning Scale (PALS. Midgley et al., 2000). In both questionnaires, the phrasing was modified in order to tap into the English language learning, reading, and mastery skills during gameplay. From MSLQ, both expectancy component subscales; control of learning beliefs (e.g. "Se on minun oma vikani, jos en opi kunnolla pelin englanninkielisiä sisältöjä") and self-efficacy for learning and performance (e.g. "Uskon pärjääväni hyvin tämän pelin englannin kielisyyden kanssa"), were selected for our study (four

and eight items, respectively). Three items from the self-efficacy for learning and performance -scale were removed because of difficulties in proper translating and phrasing, bringing the total amount of items from these scales to nine. Both the control of learning beliefs and self-efficacy for learning and performance as well as previously mentioned metacognitive self-regulation show adequate internal consistency and predictive validity in their original forms, measured by student course grade (Pintrich, Smith, Garcia, & McKeachie, 1993). From PALS, 5-item academic efficacy -subscale was selected. Academic efficacy -subscale assesses students' perceptions of their competence to do their class work with questions such as "Olen varma, että tulen hallitsemaan pelissä vaadittavat englannin kielen taidot" and "Vaikka englanninkielinen työskentely on pelissä hankalaa, voin oppia siitä" (Midgley et al., 2000). This subscale has been shown to possess acceptable internal consistency (Ibid.) and high reliability (Ross, Blackburn, & Forbes, 2005). The final, combined, scale included 14 statements measuring English language self-efficacy. The MSLQ answering scales were modified from a 7-point Likert scale to a 5-point Likert scale in order to be comparable with PALS. Aggregate score from this combined scale was used to assess English language self-efficacy as well as to indicate the general self-efficacy in a questionnaire form since many of the statements had such broad terminology (with three of the items merely alluding to the English self-efficacy in particular).

Transcribed audio data for the final group gathering was also used to assess this research question. Specifically, questions concerning general self-efficacy as a learner as well as attitudes towards academic learning were presented. We examined and reported the most salient answers and notions relating to these questions in the last paragraph of this research question.

3. RESULTS

3.1 Game's effects on self-regulated learning

3.1.1 Frequencies of metacognitive strategies during game sessions

The eight calculated metacognitive strategies are depicted in the Figure 3, along with their frequency through all game sessions. Presence of the metacognitive strategies can be divided into four groups based on the frequency of excerpts. Summarization (174 excerpts) was the

most used metacognitive strategy during all game sessions. Visual representation, switching between information sources, and requests of help were the second most prevalent with each having well over 100 excerpts. Metagaming and perception of saturation both accounted for nearly 50 found excerpts. Lastly, time management and hypermedia were the least used metacognitive strategies, their use being limited to 25 and 23 cases, respectively.

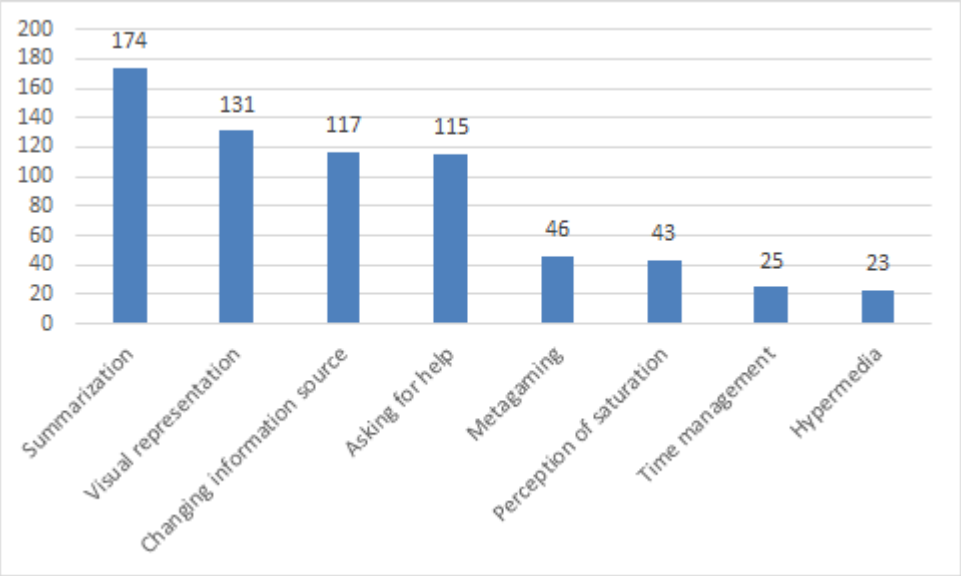


Figure 3. Frequencies of metacognitive strategies during all game sessions

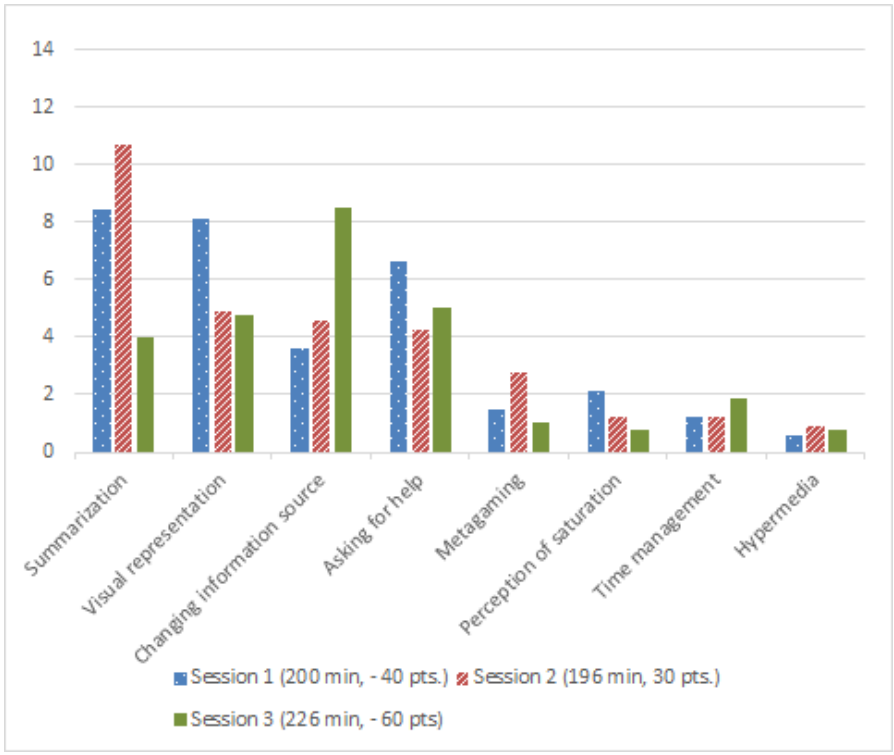
3.1.2 Comparing the levels of metacognitive strategies and game scores between pair 1 and pair 2

Pair 1 had a wide variation in their game scores: -40, 30, and -60 points on their respective gaming sessions 1-3. As for their metacognitive strategy usage, they had an increasing trend in their use of time management and, most notably, in their use of different sources of information, as visible in the Figure 4; especially from their second gaming session (15 excerpts) to the third one (32). A downward trajectory is visible in their saturation-related discourse (from 7 to 3 excerpts). Summarization was not as present in the last session as in the other two gaming sessions (15 excerpts versus 28 in the first and 35 in the second session). Visual representation was most utilized during the first playthrough, with 27 excerpts.

The second pair's gaming scores were 15, -15, and 35 points, respective to the gaming sessions 1-3. They had a clear peak in their use of metacognitive strategies in their first gameplay session; seen in the categories of visual representation, the use of different kinds of

information sources, but also in their requests for assistance (Figure 4). It is noteworthy that also their use of metagaming and saturation were at their highest in the first session. The overall high numbers of metacognitive strategies are to be considered also in relation to the amount of transcribed text; particularly when comparing the two pairs. As for the second pair, their first session had significantly more words (approximately 19 100) compared with the second and third session (approx. 11 000 and 13 800, respectively), even with the third playthrough taking up roughly the maximum amount of time (4 hours). This amount of in-game talk is much larger when compared to pair 1, whose most talkative sessions included approximately 11 000 with the least talkative being 7 400 transcribed words.

Game scores of each pair showed an inverse trend: where pair 1 succeeded particularly well, pair 2 struggled, and vice versa. Next, researchers started to examine whether changes in the quality and quantity of metacognitive strategies for each pair could have accounted for these opposite changes in game scores. Three moderately interesting observations were made. Firstly, the particularly low score for pair 1 in session three occurred simultaneously with the drastic increase in their changing of information sources. Secondly, the markedly high score for pair one coincided with an increase in the use of strategies of summarization and metagaming. Lastly, the number of metacognitive strategies used did not consistently predict the performance for either pair. The use of metacognitive strategies decreased for both pairs, although this decrease was much less pronounced for pair 2. This decrease in strategy usage didn’t seemingly affect performance in any predictable fashion.



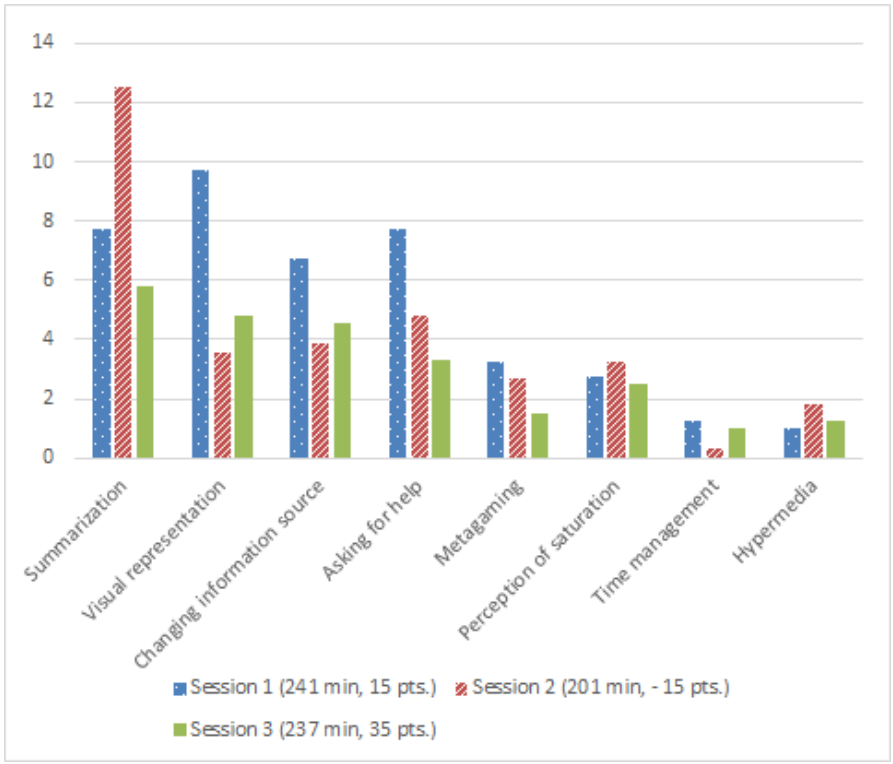


Figure 4. Time-controlled frequencies of metacognitive strategies (per hour) for both pair 1 and pair 2. Session lengths and scores are noted in the bottom of the diagram.

3.1.3 Participants' use of and changes in self-regulated learning in game sessions

Based on the each participant's individual interviews made after the last gaming session as well as the final group gathering, four separate combined categories of SRL were formed that tied the gameplay of *Sherlock Holmes Consulting Detective* to different expressions of SRL. These categories are the following: the development of note-taking skills, effect of immersion on SRL, the development of skills in pair-working, and similarities in SRL between gameplay and academic learning.

Through the game sessions one of the pairs remarked a change in their note taking as a metacognitive strategy. Development of note-taking was evident in one participant's account where he first classified information mechanically, but decided afterwards to use a timeline or a list of persons to save time:

> M1: *"mmh joo ensimmäisellä kerralla ja toisella nii tuli tehtyä semmosta niinku vaa ööh listaa ja tota ehkä nyt tässä viimesellä kerralla niinku rupesin sitte enempi niinkun semmosia omia hahmotelmia niinkun tekemään semmosta niinkun aikajanaa ja semmosta niinku henkilöistä semmosta niinku listausta että tota päätin että en ite keskity siihen näitä listaamaan tätä juttua et siinä menee mulla sitte niinku siihen aikaa ja saan niinku keskityttyä niinku omalla tavalla…"*

Changes in note-taking were also brought forth by another participant, who recalled starting to use the same paper as his pair for note-taking in order to focus attention and to reduce downtime.

> N1: *"se meni enemmän niin että parilla ekalla kerralla niin jompikumpi meistä teki ne muistiinpanot mut sitten vikalla kerralla me tavallaan tehtiin ne sitte yhessä että se ei ollu et yks tavallaan vaan kattoo siihen paperiin ja [nauraen]-*
> M1: *mmh-*
> N1: *-kirjottaa ja sit se toinen ei ees ka kato sitä paperia ja"*

In general, notes were utilized, e.g. "when taking a step back", as the primary way of tracking progress; expressive of the monitoring and controlling phases of the regulation of cognition (Pintrich, Wolters, & Baxter, 2000). Furthermore, note-taking was leaned onto in such a quantity for one of the participants to wish for the quality of her note-taking to carry on to her school environment.

M2: *"vähän sama että että mitä muut sano että välillä niinkun pysähtyy kattoo sitä kokonaiskuvaa ja ehkä yks on kans se että että ke tekee niitä merkintöjä siinä tulee niinku kirjottaneeks osioita ylös menee vähän tehokkaammin päähän ja sitte tullee pidettyä kirjaa niistä"*

N1: *"(…) kun sen vain muistas niinkun käyttää koulussakin eikä tuhertas vaa mitä tahansa sinne vihkoon nii [hymähdys]…"*

The participants highlighted notions which can be classified as effects of in-game immersion on self-regulated learning. The storytelling element of the game kept participants thinking about their performance and reflect upon their learning after the game, which is an important aspect of self-regulation. This notion is apparent in the following two excerpts:

N2: *"(...) Mut kyllä sitä tietysti aina pelikerran jälkeen niinkun pohti aina et mitenkäs tää nyt sillä tavalla pelas ja että mitenkä jätti joitain juttuja ehkä huomioimatta mutta ei niinku sillei ei sen kummemmin ehkä[nauraen]"*

M1: *"(...) Ehkä siinä vähän rupes sit sillei pelikertojen jälkeen niinkunn öö miettii niinkun syvällisemmin niitä tota (…) Miten miten sitä niinkun ongelmaa ratko ratkotaan nii vois ... kehittää"*

At the same time, immersion during gameplay created potentially harmful moments to SRL. At times, the flow of the game was so alluring that the basic objective of learning was lost in favor of the storytelling element of the game.

N1: *"(...) Että jos me ei oltas kirjotettu niitä muistiinpanoja ni se ois saattanu ihan hyvin vaan unohtaa jotain siinä kun on niin kiinni siinä pelissä nii"*

Participants observed a development in their skills of pair-working, particularly in their co-operative skills with an unfamiliar person as well as in their skills in adapting to another person's way of working. Peer learning and peer work is seen as an important component of contextual regulation of learning by Pintrich (2004).

N1: *"Nii kyllä siihen nyt ainakin oppi työskentelemään ihan niinku aluks vieraan ihmisen kanssa ja sitte se tavallaan se yhteistyö taito kyllä se on ihan hyödyllinen niinkun ihan arjessakin että pysty pärjäämään tavallaan erilaisten ihmisten kanssa ja koulussakin tekemään niitä ryhmätöitä*

N2: *Ehkä vielä sillä tavalla myös sopeuttamaan sitä... omaa tapaansa niinku jos toisella on vähän niinku erilainen tapa ei vaan puske sitä omaa tyyliään tai muuta vaan sitte niinkun ihan sopeutuu niinkun ihan tilanteen mukaan"*

On the other hand, unfamiliarity with the learning partner was found to be hindering one participant's own expression of ideas and insight, an occurrence limited not only to game based learning.

N2: *"Ää. Et nytten ku sä et, tai ite ei niinkun uskaltanu välttämättä niinkun niin hirveesti lähtee ajamaan niit omia mielipiteitään-*

T2: *Ym.*

N2: *Tai semmosia, mikä ois vähän niinkun helpompaa sitten niinkun, niitten ihmisten kaa-*

T2: *Ym.*

N2: *Jotka tuntee paremmin."*

The similarities between the functions of in-game behavior and academic environment were explicitly presented by the participants in information seeking, effectiveness, saturation, and the collaboration of information-gathering.

When asked to compare the in-game and non-game environments, a participant found similarities between the two especially in the skills for information-seeking (in utilizing varied and effective sources of information), and in the need to analyze the current situation based on the "what we know so far".

T1: *"Tuliko teillä sellasta oloa et niinku jotkut semmoset asiat mitä te havaitsitte nii et ne ois semmosia mitkä toteutu tavallaan vaan siinä pelimaailmassa et oliko jotain sil sillä tavalla et se ei sit ikään kuin vaikuttais sitten muussa elämässä*

N2: *No emmä tiiä siis ku sitä rupee niinku syvällisemmin miettimään että niinkun... Mitä see joudut tavallaan jos siinä pelissä niinkun niinkun et sun pitää... Tavallaan tietää mistä sää lähdet niinku hakemaan sitä informaatiota ja niinkun ensinnäkin se alkutilanne että oikei kahtoo et mitkä tiedot sulla on ja sitte niinkun tavallaan että mihinkä suuntaan siitä lähtee ja tämmösiä että niinkun kyllähän siellä niinku aika monia tarvitaan et kyllä normaali ihan opiskeluelämässä sit niinku tavallaan et hei okei jos sulle annetaan joku tämmönen keissi ja sit*

sun pitää tietää et mitä hakusanoja sää lähet hakemaan vaikka googlesta tai scholarista vai tämmösistä niinku asioista ja sitten niinkun... Sillä tavalla ehkä niinkun... On se sillei kun alkaa niinku pitemmälti miettimään ni aika paljon semmosia taitoja mitä tarvii niinkun oikeessakin elämässä"

As the game incentivized effectiveness in that any location visited will lessen the scenario's final score, a participant countered an argument from another participant for the possible impact of wasting effort being a factor also in researching and studying in general, followed by the agreeing echoes from the other participants.

N1: *"(...) Se ei ihan päde niinkun arkielämään että ähh ku sä lähet ettimään tietoa nii sillähän ei ole oikeestaan väliä että että kuinka monen vaiheen kautta sä käyt mut jos sä löydät sen oikean vastauksen lopulta niin tavallaan sithän sä oot saanu sen mitä sä oot lähteny hakemaan.*
N2: *No onhan siinä se että kuitenkin että tavallaan sä tuhlaat niinkun turhaan aikaa johonkin jos sä lähet seuraa jotain ihan-*
M2: *Mmh-*
N2: *Semmosta epäolennaista niinku tietoo ja sit sä hoksaat sen jossain vaiheessa et ei tää ollukkaan relevanttia ol millään tavalla tai liittyny niinku mulla on joskus-*
M2: *Mmh-*
N2: *Niinku alkuna kirjottaa tavallaan niinkun aiheen vierestä jotain-*
N1: *Mmh-*
N2: *Ja sit tajuaa sen jossain vaiheessa kun rupee miettimään et ei tää oikeestaa vastaa tähän kysymykseen millään tavalla et se onkin liitty sit johonkin toiseen juttuun ja et kyllähän se niinku aikaa ja niinku-*
N1: *Mm joo-*
N2: *Eforttia hukkaa siinä et jos sää niinkun oppisit jotenkin hyödyntämään ja työskentelmään sillä tavalla tehokkaammin et ei lähe tavallaan nii herkästi tämmösille sivuraiteille*
N1: *Mmh totta"*

The second pair argued for the benefits of knowing the necessities, and for acknowledging of possessing the required amounts of knowledge about the subject.

M2: *"Ehkä siin' on niinku no ehkä parhaimmillaan jos lukee tenttiin ni sitte saattaa niinkun muodostuu se kokonaiskuva et mitä oli näitä ydinasioita saattaa olla joskus jos on viikottaisiakin tehtäviä nii sitte tu tulla sellanen tehtävä että kymmenestä tehtävästä nii tällä haettiin niinku vaikka kolmee niinku semmosta niinku semmosta tärkeetä juttuu tällä viikolla*

ja nytten mää tajuun niinku että mikä tää juttu on mikä ilmiö tai tai mitä tätä juttua nyt käytetään tai näi et itellä on semmonen perusfiilis ni sit se riittää jo sillai että tietää itekin että ei voi eikä pysty eikä tarvitse niinku tiet hallita sitä sataprosenttisesti että niinku se päähomma ois siin niinku siinä ehkä siinä pelissä oli vähän samaa että kun oli se fiilis että että niinku tää nyt pääosin selvillä et sit se niinku hienosäätöö nii ei se oo nii justiinsa sitten niinku joku pieni pienempi yksityiskohta... Sitten riittää"

The second pair characterized the game's interaction from a benefit-standpoint, as in they were able to brainstorm and test their theories following the reactions from their pair; ultimately leading to a momentum of mutually created knowledge, as seen in the following excerpt.

M2: *"No kyl siinä niiku välillä just jos on lähetty kaverin kaa pohtii jotain pulmaa öö mikä on ollu ihan niinku kouluhommia nii siinä on välillä et jos kumpikaan ei oo täysin tienny sitä ni sitte on lähetty miettimään yhessä onko se vai eikö se oo ja sitte niinku mietitty eri vaihtoehtoja ja sitte siinä niinku poissuljettu osia ja katottu et tää ei nyt johtanut mihinkään et ainakaan vielä ja sit välillä voi saada kaverilta jonkun idean et hei toi on hyvä idis mut sit se kaveri ei ois sen senkään idean avulla välttämättä viel päässy maaliin vaa sitte että no nappaa sen kaverin idiksen ja sit yhistää vaikka omaansa ja sitte saattaa sillä päästä eteenpäin että saattaa vähän niinku kimpoilla kaverilt kaverille ja sit saattaa päästä siitä niinku maaliin tai ainakin sillai että se menee johonkin suuntaan eteenpäin..."*

Although participants expressed many similarities between self-regulation in gameplay and academic learning, they had their doubts about the transfer of these skills and techniques into their regular academic environment in practice. Both the lack of explicit SRL strategy training and the compelling gameplay meant that the participants had trouble in conjuring up potential "take home" -messages from game sessions as is explained in the following excerpt.

N2: "*No ei hirveesti mää jotenkin pidin en miettiny sitä niin sanotusti tämmösenä niinku niin sanotusti tutkimuksena mää vaan pidin sitä hauskana pelin pelaamisena enemmänkin enkä välttämättä nyt lähtenyt niin kovasti pohtimaan näi pelikertojen jälkeen että mitäköhän tästä sai käteen sillä tavalla öö…"*

Based on the descriptive analysis of the questionnaire data concerning metacognitive strategy use, no unequivocal change in the use of metacognitive strategies was observed. The mean score of the combined Motivated Strategies for Learning Questionnaire (MSLQ. Pintrich,

1991) and The Academic Self-Regulation Scale (A-SRL. Magno, 2010) for all four participants was 60 in the first and 60,5 in the last game session; alluding to stable and high overall levels of metacognitive strategies.

When examining scores of individual participants, a growing trend of nine points was detected in one participant, N2. The other considerable change occured in participant N1, whose score in the use of metacognitive strategies declined by eight points. The scores in the use of metacognitive strategies for each participant before the first and after the last session are presented in Figure 5.

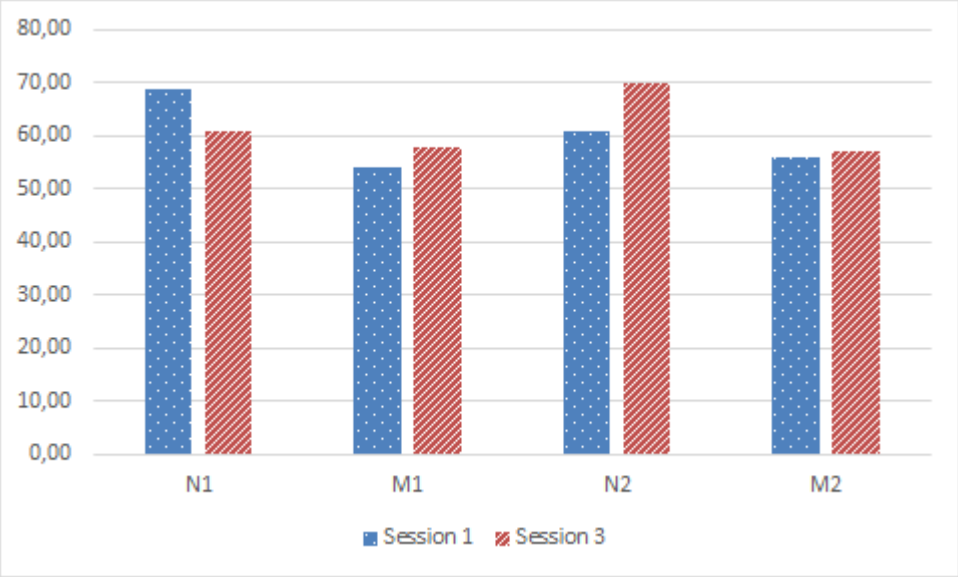


Figure 5. Scores for each participant in the use of metacognitive strategies in their studies

3.2 Self-determination during gameplay

3.2.1 Thematic analysis on the presence of self-determination during gameplay

All of the 16 discovered and coded subcategories of self-determination are listed below, sorted by their rank order within categories, and titled by their respective belonging to either a single dimension of self-determination (competence, autonomy, or relatedness) or a combination of these dimensions. A complete chart of all the discovered categories, along with their interrelations and with each categories' previous categories relating to them is presented in figure 6

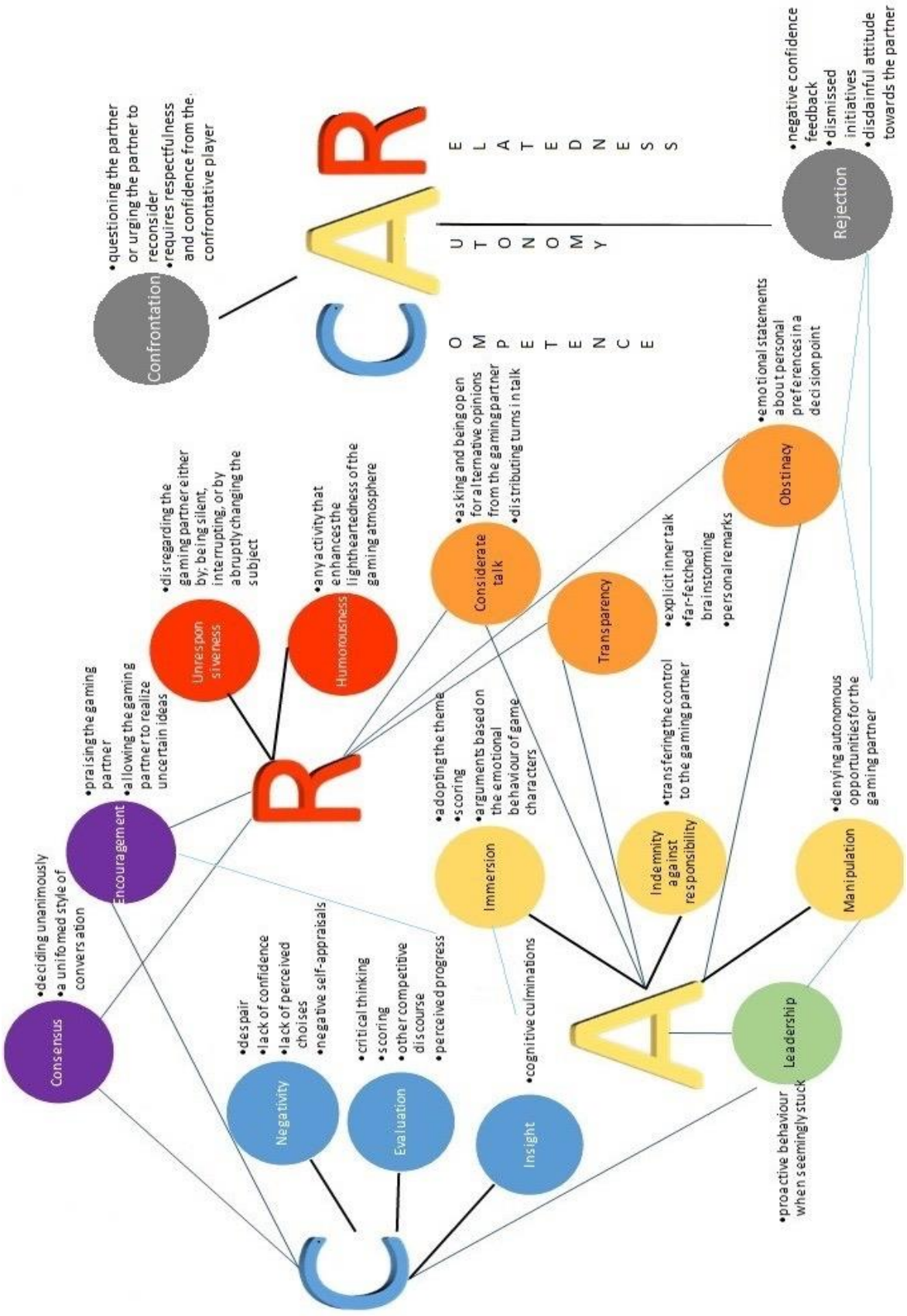


Figure 6. Subcategories of self-determination in *Sherlock Holmes Consulting Detective*, developed from the results of research question 2

Competence

In the order of prevalence, the following three categories of competence were agreed upon between the researchers: Negativity, Evaluation, and Insight.

Negativity includes verbal exclamations of despairing moments, general lack of confidence, a perceived lack of possibilities, and also negative self-appraisals. The latter has similarity to evaluation due to its attributational component, but is differentiated from its negative emotionality.

General lack of confidence (session 1):

N2: "NO ei kun nää.. Elikkä näin ei kun sori. Mää taas, jooh ei. Nyt meni taas vähän.."

Negativity due to perceived lack of progress-related possibilities (session 3):

N2: "No voiaa me käydä sitä jututtamassa, jos sä haluat.

M2: Ei täs oikee taida olla.

N2: Me nyt vaan pyöritään ympyrää tässä muuten."

Evaluation contains critical thinking, the naturally induced scoring from the concluding parts of game sessions, and competitively oriented discourse. Also included are the exclamations of perceived progress, which have common ground with encouragement, but these exclamations of progress were not necessarily related to relatedness. Additionally, it was noted that the second pair had a significantly larger amount of evaluative moments than the first pair, due to their more competitive atmosphere.

Critical thinking (session 1):

M2: "Nii-in. Mut voihan se olla et se ois iteki vääräs-

N2: Niin. Niin.

M2: Et se ei ois ite huomannu sitä.

N2: Et sitten jos joku.

M2: Jos se ois keksiny sen sen metodin kokonaan väärin et millä se on kyselly niitä kysymyksii ja sit-

N2: Ymm-m.

M2: Se ois vaan epäilly näitä sen niinkun tovereita.

N2: Oiskohan niin-

M2: MUt mä aattelin et, ehk, ehkä yks tapa niinkun me ollaan käyty näitten muitten tohtorien työpaikalla."

Evaluation during scoring (session 1):

T1: "Mut joo sitte tota tuolta voitte kattoo mitä saitte pisteitä
N1: Saatiinko me tosta piste mietittiin että toi että missä se oli piilossa nii mehän epäiltiin sitä
M1: Niin no sää epäilit vähän niinku (...)
[pisteiden laskua]
N1: Kuuskyt pistettä eihän se nyt oo huono
T1: Otittekste huomioon noi
N1: Ei [naurahdus]
M1: Miten se-
T1: Joo
M1: Piti laskea
N1: Mmm ... Hmm mentiin varmaan miinuksen puolelle [naurahdus] [???]
[pisteiden laskua]
N1: Joo mentiin miinuksen puolelle (...)
N1: Mut ei nyt ihan huonosti [???] [naurahdus] kyllä me tajuttiin se veli ois pitäny vaa lähtee enemmän ton sen äitin perään sitte ei ajateltu ollenkaan kun ne puhu vaan siitä sen isästä"

An evaluative statement of perceived progress (session 3):

N2: "Okeih.. Elikkä tää oli dead endi.."

In this study, Insight refers to the cognitive pinnacle of solving a complication or deriving into a new perspective. It manifested itself with a positive echo, and thus bore resemblance to exclamations of immersion. However, insight is the culmination point of an individual mind, even though the thought process oftentimes had a shared basis.

Brainstorming an idea (session 2):

N2: "Eikä siellä sanottu mitään, että mikä se on se. Joo-hh.. Ei tuo DLT:kään sovi näihin oikein mihinkään. TAi sitten toi, missä on DLT ni se vois olla toi Drewery Lane Theater. Jos nyt, vedetään [naurahdus]
M2: Tuolla on kyllä aika paljon teattereita.
N2: Niin. Mut jos toi, toi DLT-
M2: Nii niii.
N2: Nii sit toi ois niinku Drewery Lane Theater."

Having a sense of accomplishment through solving something (session 1):

N1: "Öö tuolta ja tullu tonne meijän luo... [naurahdus]... Se ei oo se Goldfirekaan käyny meijän luona sen on pakko olla joku huijari se on vaan käyny murhaamassa pari tyyppiä tossa välillä [hymähdys]"

Autonomy

The following categories were formed as belonging to autonomy, listed here in their relative order: Manipulation, Indemnity against responsibility, and Immersion.

Manipulation occured when the active player is denying the gaming partner of his/hers autonomy; whether regarding a decision, task allocation, or dismissing the need to consult their partner altogether. Also, manipulation oftentimes had to be considered jointly with Leadership, since they both have a similar propulsive force. Whereas leadership was initiated during moments of standstill in progress to drive progress forward, manipulative statements were more evident when one player wanted to take control over actions during moments of otherwise collaborative work.

Commanding the gaming partner (session 2):

M2: "Kirjota tohon noitten, noitten viereen vaikka kakssanaset tässä niin.

N2: Oota mää.."

Passively influencing the course of action (session 1):

N1: "Nii ne ei oikeen tienny mistään muusta ku tosta bobby fieldistä että... Emmä tiiä kyllä sieltä nyt jotain uuttakin voi tietysti tulla... Ellei sulla oo jotain muuta-"

Indemnity against responsibility describes in-game situations where a player surrendered control, or the decision-making process to their gaming partner. At times, the indemnities against responsibility seemed to show itself because of indifference, because of a perceived deficit in the related skill, or due to external factors such as being tired or exhausted.

Thrusting the key decisions exclusively to the gaming partner (session 2):

M2: "Ketä me ollaan jututtamassa vielä"

Indifference (session 2):

"N1: Onko tää meijän hieno johtopää- [naurahtaa]
M1: No ... kai mennään tällä sitten-"

Immersion can be seen as players losing the track of time or, more commonly, excitedly adopting the game's theme, with its Victorian narrative and the players' roles as the assistants of Sherlock Holmes. Additionally, when players made arguments based on the game's characters emotional behavior, it was evident that they utilized their imagination about the unfolding of the written scenario. Although, there were also brief periods when the immersiveness wasn't evident, where a player would, for example, do unrelated activities with a smartphone (this was especially prevalent in the last session of the first pair) or when the players engaged in metagaming.

Relating to the game's theme and narrative (session 1):
M2: "Sherlockin apulaiset täällä juoksentelee ympäriinsä [naurahdus]"

Relating to the in-game characters (session 3):
N2: "Koska eihän se tiiä minkä näkönen se on. Ku se vaan. Se on sanonu et se on Smith, nii se on sille Smith. Eihän se tunne sitä henkilökohtasesti."

Losing the track of time (session 1):
M2: "Ollaanko me oltu täällä neljä tuntia"

Relatedness

Two categories of relatedness were deemed to exist; Unresponsiveness and Humorousness, of which unresponsiveness was more common.

Unresponsiveness is a category that highlights the moments in the discourse where a player disregarded their gaming partner. This could mean replying by changing the subject, interrupting, or simply by being silent when the partner was partly expecting a response. For the second gaming pair, there was even a few situations where both of the players were unresponsive simultaneously.

Disregarding the gaming partner (session 3):
M2: "Et oisko se voinu tietää niinkun, et kuka on käyny vaikka sen Smithin luona.

N2: Ymm-m. Ootahan nyt, jos se Rodolpho on nyt tappanu sen Smithin. Ja päästäny Novakin vapaaks. Samalla. Elikkä-
M2: Ei mut siis-
N2: Sitä epäiltäis siitä.
M2: Siis. Joku on joka tapauksessa päästäny sen Novakin vapaaks sen takia, että se pei-
N2: NIIN niin, se voi olla just se Rodolph-
M2: Peiteltäs se. Se. Se tota Smithin luona käynti. Ja Smithin tappaminen. Mutta että onko se, sitten Rodolpho vai sitten ne ihmiset, jotka on-
N2: Ymm.
M2: Mut miks se, ööh.
N2: Ootahan nytten. Et mites, mitenkäs se Johnny-
M2: Mut ollaanks me sitä mieltä, että se. Et se Smith, Smith on niinkun jeesannu sitä Rodolph, tai sitä Huanezia, että se on niinkun putsannu siellä pankkeja. Ja sitten tää on, jeesannu sen ensinnäkin maahan-
N2: Mut kuka nyt on, kuka nyt tappo sen Johnnyn. Koska sitä oli isketty puukolla. Niinkun tälleen niinkun ylöspäin."

Not reacting to gaming partner's pleas for advice or other comments (session 3):
M1: "You are close to the objective ... Onks toi nyt siihen salakirjotukseen ... Hmm
[muistiinpanojen kirjoitusta]
M1: Sanooks sulle jottai
[salakirjoituksen ratkontaa]
M1: [hymähdys] Hmm en tiiä mitä tuo tarkottaa
N1: Hmm
[salakirjoituksen ratkontaa]
M1: Sit siellä oli vielä jotain niitä yksityisiä etsivätoimistoja ja tommosia
N1: Mmh"

Humorousness includes the synchronous moments when both of the players reacted in a lighthearted way, whether by laughing or smiling together, or by making ridicule of the context or their progress.

Shared humor and ridicule towards the context (session 1):
M2: "Tosta. Ei mut voidaan käydä kattoon. Periaatteessa kattoo nää kaikki. [naurahdus]
N2 [naurua]
M2: Asiantuntijat.

N2 [nauru jatkuu]"

Taking a casual stance towards a failure (session 3):

T2: "Mmh jaa kuka tappo sen

N1: Hmm [hymähdys] no sitä me ei kyllä tiietä [naurahdus]

M1: [hymähdys]"

Competence and Autonomy

One category, leadership, was evaluated as fulfilling competency and autonomous needs of the individual. Leadership demonstrated itself during the playing of *Sherlock Holmes Consulting Detective* when one of the players behaved proactively in a situation in which progress had halted. Alongside the previously mentioned similarities to manipulation, leadership also bore some resemblance to encouragement and evaluation.

Proactive behavior after recognizing the other player's frustration (session 2):

"[M2 huokaus]

N2: Noh. Lähetäänkö näillä tiedoilla vai.

M2: Voi kai se tietysti."

Proactive behavior to evaluate the current situation by summarizing (session 3):

M2: "Joo. No, mikäs. Onks meillä siis. Käydäänkö läpi se visio, mitä-

N2: Okei.

M2: Tää kuvio."

Competence and Relatedness

Two categories, Consensus and encouragement, in this order of prevalence, were classified as being supportive of both the needs of competence and relatedness.

Codes indicating consensus comprised of moments of gameplay where both players were unanimous in either their interpretation of past knowledge or their future courses of action in game. Consensus was evident in extracts were one player verbally agreed to other player's plans or interpretations of acquired information. In addition, consensus was conveyed in mutually constructed explanations for the murder mystery where players finished each other's sentences in a lively fashion.

Verbal agreement (session 2):

"N1: Must vähä alkaa tuntumaa et se on toi Oliver on tehny noita en tiiä
M1: Joo mulla kanssa mulla kanssa siitä"

Finishing each others' sentences (session 2):

"N2: Itse asiassa se voi, se on itse asiassa voitu tappaa ennen ku se on menny sinne, koska aatellaan okeei. Täää, tää oikee Goldfire on menny sinne. Nyt tää, joka esittää olevansa Goldfire on menny sinne-
M2: Tappanu-
N2: Tappanu sen siellä, menny.. Sitten sieltä, sitten tappaa-
M2: Eastonin.
N2: Eeh, juuh. Sen, Helm-
M2: Eikun siis-
N2: Chaaarlesin, Chaarlesin.
M2: Jooh, jooh.
N2: Lähteny sieltä-
M2: Ja sit sen jälkee tullu Holmesille-
N2: Tänne. Ja sitten menny Southampton, mitä on Southampton Roadilla"

Encouragement was evident in game as praise given to the gaming partner for their insight or successful decisions. It was also present in moments were the other player was unsure of his or her plan of action or observation. In these situations encouragement from a partner allowed the player to carry out their intuitions into action (second extract).

Praise (session 3):

"N2: Nyt me voitais ehkä käyä myös täällä kattomassa. Ku täällä on joku tämmönen.
M2: Niin!
N2: Käydä kysymässä, että-
M2: Toi-
N2: Tietääkö ne tosta mitään
M2: Toi on ihan hyvä spottaus, näyttäs vähän samanlaiselta."

Reassuring the gaming partner (session 1):

"N1: No mietin ... Mmm sit tää voi olla aika kaukaa haettu mut toi yks kirjahan on saksaks nii ja sitä oli mainittu muutenkin et se luki saksankielisiä kirjoja nii täällä on tuolla on emmä tiiä eii ei se

M1: Ei mikä on mikä ois ollu

N1: Emmä tiiä ei mmh emmä oikein tiiä mitä [hymähdys] tai no nii [huokaa] ... Mää vaan mietin että että pitäskö meijän yrittää paikantaa se missä sitä oli yritetty ampua ku se sano että"

Autonomy and Relatedness

The categories of Considerate talk, Transparency, and Obstinacy, in this order of prevalence, shared the qualities of autonomy and relatedness.

Considerate talk is a combination of codes which all could be described as allowing the gaming partner to influence decisions made in game. Considerate talk was expressed in game by asking for partner's opinion, offering alternatives, distributing turns in talk, and being considerate of gaming partner in player's own actions, each of which are discernable from the following extracts.

Being considerate (session 1):

"M1: Mmm tuntuuks siltä että toi ois nyt sun mielestä paras vai-

N1: Nii

M1: Mikä tuntuu että mistä lähtee

N1: Nii musta se ois ehkä paras mennä sen Mycroftin luo kysyä siltä tietäskö se mitään siitä perheestä muuta ... Mutta mää en oikein osaa sanoo onko mitään muuta mitä mieltä sää oot"

Distributing turns in talk (session 3):

"N2: Mut sitten täällä oli kanssa-

M2: Onks meillä mitään väylää-

N2: Ööömm. Coroner for this case. Mutta niink, mutta niin, mitä sanoit."

Asking for an opinion (session 2):

"M2: Mut kuka se oli vielä se, mikä sulla oli mielessä se yks ihminen.

N2: Mikäh.

M2: Se, joka oli ollu siin aiemmassa näytelmässä.

N2: Siis se Stanley, joka oli siinä kolm, kolmiodraamassa. Mistä see, se ja se Sabbalini tappeli. Sen Henrik seitsemännen näytelmän. Aikana."

Transparency was formed to refer to sections in-game where a player explicitly (verbally) expressed inner talk; including the unobstructed expression of even far-fetched ideas and personal remarks. Additionally, many of the metacognitive strategies had common ground with transparency; e.g. when a player brought forth his/hers reasoning (argumentation and elaboration), or the current situation and the related facts (summarization and time management, or, requests for help on a personal level).

Remark of a personal characteristic (session 1):

"N2 Mä vaan haluaisin kyllä selvittää. Mulla nyt on kyllä todella-
M2 Sulla oli se-
N2 Mulla on todella, mulla on todella inhottava niinkun tämä et jos jätetään asioita kesken mutta kun mä haluaisin tämän tietää et mitä, mitä-
M2 Mikä se oli."

A far-fetched idea (session 2):

"M2: Jutulle. Yks semmonne villi ajatus mitä tuli mieleen et oisko.. Sit voinu olla jotai hypnoosiaki [naurahdus]? Ei, voi tietää. Tuli vaan.
N2: No voi olla mahollista tietysti."

Egocentric speech (session 3):

"M2: Tää journalisti, police gazette, source of information, criminal case. Ei se vissiin oo se. Eei. Jaa poliisit. Niin tää, täs sanotaan et poliisin kohalla että heillä on raportit ja yksityiskohat keissiin liittyen, mut siellä sitä ei kerrottu. Mut sitten tää on taas tää arkisto, öööh, report. Report. Tai näin."

Obstinacy was identified as a category in which players spoke their minds about what they would want to do in game. This type of talk was used to produce emotion-driven statements about one's own preferences. Although obstinacy was often successful in persuading the other player to change his or her course of action, it was sometimes also seen as abrasive to the harmony of the two players. This was especially true when the partner was visibly displeased or irritated because of it. Obstinacy was similar to manipulation in that they both deny control from the other player, who gets left in a passive or observing position. However, as opposed to manipulation, obstinate utterances weren't necessarily meant for dismissing the other player consciously.

Autonomy-reducing statement of personal preference (session 3):

"M2: Käytiiks me tässä, tässä osotteessa.

N2: Ei.

M2: Eli seiska SE.

N2: Mut. Mä haluun tietää et mitä näissä sanottiin. Siis niinkun.

[M2 huokaus]."

Competence, Autonomy, and Relatedness

From the transcripted game sessions, Confrontation and Rejection, former of which was more common, were identified by both researchers as encapsulating all three basic psychological needs of competence, autonomy, and relatedness.

Confrontation during gameplay denotes the willpower and self-confidence of a player to question the logic or conclusions made by the other player. Unlike obstinacy, confrontation didn't imply the use of emotional persuasion to change the other player's point of view. Also, confrontation differed from manipulation in that it didn't reduce options the other player had in the game. Confronting urged the other player to reconsider his or her stance regarding information pertaining to the case, thus maintaining autonomy for both players.

Respectful disagreement (session 3):

"N2: No kai ne ois, huomannu jos se ois ollu 22-vuotias [naurahdus] nuori mies.

M2: Mut siis oliks tässä sanottu missään et se oli vanha.

N2: Ei mutta täällähän se oliii, ömm. Ömm. Niinkun, missä se on. Ööm, I thought it was. It was normal due to his age.

M2: Eeiku täs mun mielestä viitataan siihen Dumontin ikään.

N2: Aaah!"

Rejection emerged in game sessions as contemptuous and invalidating responses to other player's suggestions and ideas. While both rejection and confrontation both aim to express disagreement, effects of rejection were seen by the researchers as the complete opposite of confrontation. Rejective statements included negative competence feedback, dismissed initiatives, and established a disdainful attitude towards the other player.

Abrupt feedback (session 3):

"M2: Niin mä en tiä et oisko sieltä poliisiasemalta selvinny se. Henkilöllisyys. Mut toisaalta me ei niinkun.

N2: En mä usko."

Minimal answering to the partner's initiatives (session 1):

"M2: Siis käytiiks me tän.
N2: Kenen.
M2: Archived with the-
N2: Eei.
M2: Office of the national-
N2: Eei, ei käyty.
M2: Compiles ancient league and criminal documents...Siis, sä oot varma et me ei käyty-
N2: Ei.
M2: Erittäin vanhojaa-
N2: Ei käyty.
M2: Lakii, laki ja-
N2: Ei."

3.2.2 Questionnaire data concerning self-determination during gameplay

Descriptive analysis of Player Experience of Need Satisfaction -scale (PENS. Ryan, Rigby & Przybylski, 2006) revealed no salient change in participants perceived satisfaction of psychological needs. Apart from participant M2, scores in this construct actually decreased by approximately two points each. The mean scores of all participants for need satisfaction were 27,01 in the first session and 26,15 in the last session out of the possible 35 points.

3.3 Game intervention effects on motivation for learning

3.3.1 Changes in internalization of motivation

Participants' scores on internalization of motivation during game session are shown in figure 7. When examining change trends of internalization scores of individual participants, a single considerable increase was observed. Participant M1's score of internalization of motivation increased from 40 to 51,2. Thus, it seemed that one participant's perceptions of the game's

usefulness and value to enhance academic learning skills increased between game sessions, while for others these perceptions remained the same.

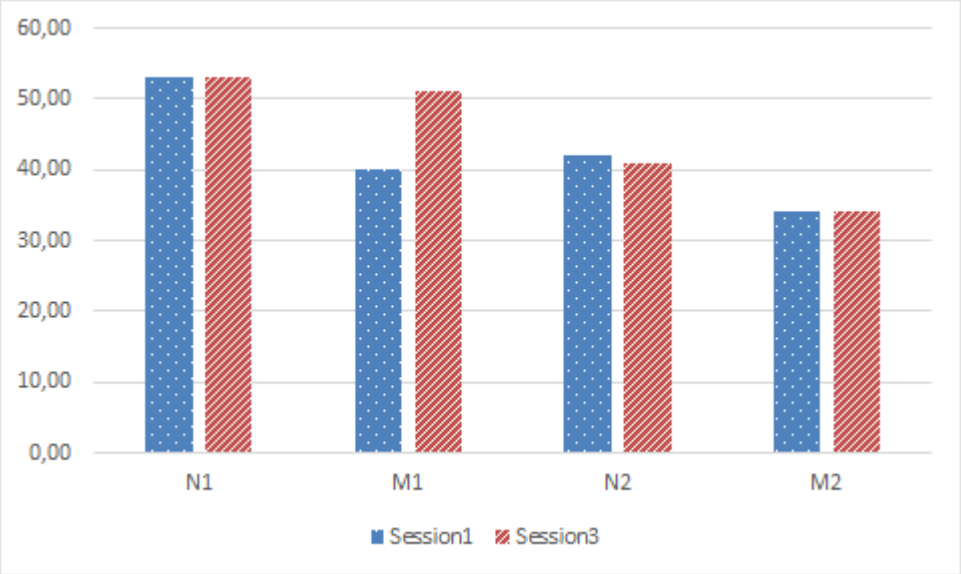


Figure 7. Scores on the Internalization of Motivation scale measuring internalization of motivation during game sessions

3.3.2 Changes in English language self-efficacy

On an individual level, our measure, adapted from the Motivated Strategies for Learning Questionnaire (MSLQ. Pintrich, 1991) and Patterns of Adaptive Learning Scale (PALS. Midgley et al., 2000) showed a growing trend in perceived English language self-efficacy in one of the four participants. This participant's (N1) scores increased on the modified self-efficacy scale from 52 before the first game session to 61 after the last game session. Also, the self-efficacy scores of the second female participant, N2, increased slightly from 54 to 59. Figure 8 shows each participant's scores of self-efficacy in English language during game sessions.

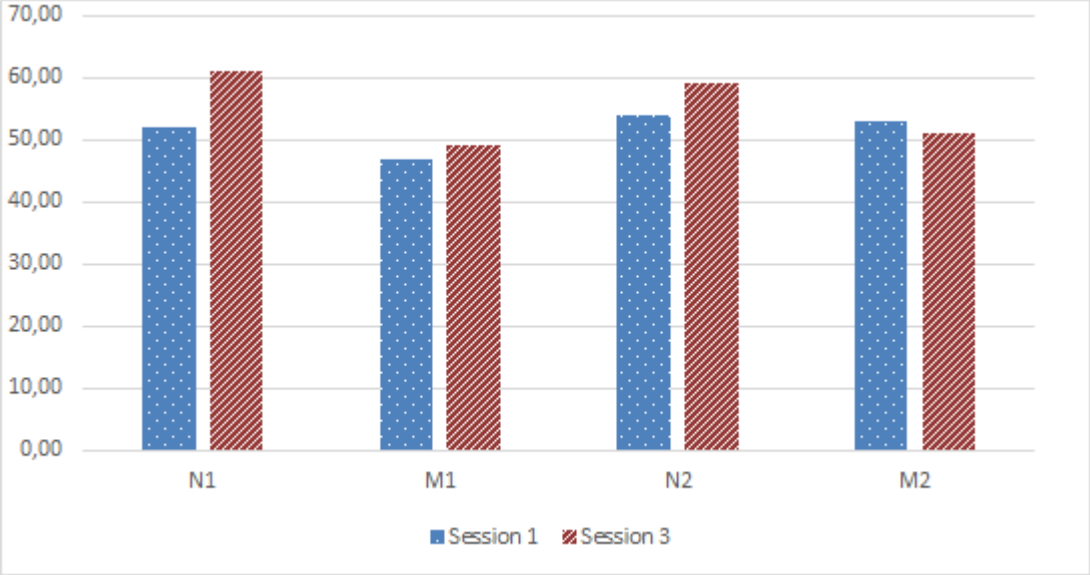


Figure 8. Scores of self-efficacy in English language during game sessions

3.3.3 Participants' experiences of game intervention on their general self-efficacy as learners

Besides referring to English language, Figure 8 also has indicative value on the changes in general self-efficacy. However, based on both the interviews made after the last gaming session as well as the final group gathering, gaming sessions had very little effect on participants' learning self-efficacy, even when directly inquired. Only one such explicit mention was made, by N1, supporting the increase in her self-efficacy (Figure 8). In the extract, the participant mentions her skills as a note taker improving as a result of the game sessions:

> N1: *"Niin no ei se itelläkään sillee se oli niin se oli enemmän semmosta hauskaa pelaamista mutta tavallaan ainoo mikä mie huomasin että oli että äh ... Ei oo aina hirvee luottamus omiin muistiinpanoihin myöskään koska mutta sitte tavallaan siinä tajus ... Kuitenkin että ehkä mää jollain tasolla osaan kirjottaa kuitenkin ihan jos multa vaaditaan nii osaan tehä hyviä muistiinpanoja kyllä että niistä saa sen tiedon mitä kaipaa ehkä mutta kun sen vain muistas niinkun käyttää koulussakin eikä tuhertas vaa mitä tahansa sinne vihkoon nii [hymähdys]"*

4. DISCUSSION

The general objective of our endeavor was to examine the possibilities of a collaborative and gamified context as a learning environment to implicitly enhance self-regulated learning. Our underlying presumption was that if a commercial off-the-shelf board game would exhibit natural potential as a medium for change in its players' ways of learning, then pre-existing theories and models of learning could be utilized to refine these mechanisms further into more scientifically sound learning environments. One such potential theoretical backdrop is that of socially shared regulation of learning (SSRL. Hadwin, Järvelä, & Miller, 2011). Consistent with SSRL, the metacognitive strategies weren't calculated by the individual participants. Rather, it was done by combining the pair's frequencies of metacognitive strategies, since each participant seemed to share a similar overall approach focus (Pintrich, 2000b) in their goal orientation (when interviewed) to learn as part of their mastery orientation (Dweck, 1986; Harackiewicz, Barron, & Elliot, 1998), and to perform well as part of their performance orientation (Dweck, 1986; Harackiewicz, Barron, & Elliot, 1998) in the game's joint problem solving. Similarly, it was thought of importance to organize a final joint gathering, not only to gather more interview-data, but to have both pairs together evaluating their overall learning processes and their goal orientation, and to share and compare their in-game experiences and thoughts on the similarities of self-regulated learning in-game to school environments with the other pair, solidifying their goal attainment.

The aim of our current study was to investigate whether *Sherlock Holmes Consulting Detectiv*e -board game would affect participants' self-regulated learning. Specifically, we were interested in how metacognitive and other self-regulatory learning strategies were present in-game, and how these strategies would apply to participants' general self-regulation of everyday studying. We also assessed whether the participants would recognize value and usefulness of playing the game in cultivating learning skills for academia (internalization of motivation) as well as rate themselves differently in terms of efficacy in English language and as learners in general. Another purpose of our study was to enquire the game's potential to tend to the psychological needs of its players on the levels of competence, autonomy, and relatedness. Additionally, we went on to investigate the nature of how they appeared to manifest themselves during game sessions as that lends us to draw further insights on the related basic motivational needs and how do they interact with SRL.

4.1 Summary and discussion of the key findings

Based on our content analysis of moments indicative of metacognitive strategy use, summarization of recently acquired information was by far the most used metacognitive strategy used by both pairs. Summarization of recently acquired knowledge has been found to improve comprehension, to lead to effective note-taking in lecture contexts (King, 1992), to increase vocabulary, and to improve reading comprehension in third graders (Boulware-Gooden, Carreker, Thornhill, & Joshi, 2007).

Visual representation of information, changing information source, and asking for help were also prevalent during game sessions. Our conceptualization of visual representation of information was different to those used in other studies and as such, direct comparison to other similar research is difficult. We operationalized visual representation of information to capture moments where participants directed their partners' attention using a physical modality (i.e. finger, pen), whereas other studies (focusing in this same concept) have studied techniques such as note-taking and drawing. For example, a meta-analysis conducted by Kobayashi (2006) found that note-taking significantly improved performance in knowledge acquisition compared to not taking notes or mentally revising the material. In addition, interventions for improving note-taking skills lead to similar performance improvement when compared to note-takers receiving no such instruction (Kobayashi, 2006). Van Meter (2001) found that in sixth graders, instructed self-generated drawings increased test scores on a problem solving task involving reading a short science text. Direct linkages between the previously mentioned study results and our visual representation of information are tenous at best, since the purpose of these two metacognitive strategies are slightly different (directing other person's attention versus using a memory aide). Benefits of changing information sources during a study task have not been studied, to the best of our knowledge. Nonetheless, we would argue that appropriate switches to most useful sources of knowledge needed to further study goals is a positive feature in a learner. However, changing of information source in our study was not necessarily a positive action, since thoughtlessly rummaging unimportant clues in-game was disadvantageous from a game score perspective. Finally, adaptive help seeking has been shown to improve course grades in college students in writing tasks (Williams & Takaku, 2011). Thus, visual representation of information, changing information source, and asking for help seem to be to some degree beneficial in achieving learning goals, and in *Sherlock Holmes Consulting Detective* these strategies are in use.

Management of time and use of hypermedia were the least utilized metacognitive strategies found in our study. Time and study environment management, along with e.g. self-efficacy for learning and performance, and metacognitive SRL were found out to be correlated statistically significantly to the final course grade, when Pintrich developed the MSLQ-scale (1993). On a general level, Macan, Shahani, Dipboye, and Phillips (1990) found various time management skills, especially perceived control of time, to be highly correlated with self-reported GPA as well job and life satisfaction in college students. These time management strategies have also been shown to predict academic performance in the future the same way as SAT scores or prior GPA (Kitsantas, Winsler, & Huie, 2008). To the best of our knowledge, no studies have been conducted examining the usage of outside material on formal learning situations or performance, reducing our possibilities for interpreting effects the limited use of hypermedia had on game session performance. The use of such a strategy can be seen as a form of control and modification of insufficient contextual learning environments and as such, beneficial to learning goals (Pintrich, 2003).

When controlled for time in game session, the number of metacognitive strategy uses remained quite similar through all game session for both pairs. Based on our transcribed game sessions, pair 2 was much more talkative than pair 1. Taken together, this talkativeness of pair 2 didn't transfer unequivocally to an increased use of metacognitive strategies. Each scenario required slightly different approaches to be solved effectively. The first scenario required combining different points in the map in order to get a picture of the events; increasing the need to utilize visual representation. The second scenario required reading a timetable to deduce possible suspects from a vast list of them; increasing the need to summarize. The final scenario required the use of a decoder to open crucial hints pertaining to the case; increasing the need to ask help. The use of metacognitive strategies for each pair in each session followed somewhat of a similar pattern, especially in the domains of summarization, visual representation, and asking for help. This leads us to believe that, to some degree, the quality and quantity of metacognitive strategies was more affected by the scenario played rather than by the changes in players' self-regulated learning. The similarities in metacognitive strategy use, combined with an observation that the scores for each game session followed a inverse trend for the pairs, seemingly indicates that no definite statements linking specific metacognitive strategies to improved performance can be made. However, it can be said that both pairs were adapting to the requirements of the specific scenario as the appropriate metacognitive strategies were used more frequently, relative to the other scenarios. Moreover, the overall decreasing trend of the amount of metacognitive strategies suggests that both pairs

had developed their collaboration to demand less meta-level discussions on the pertaining issues.

Some effects linking a use of a specific metacognitive strategy to performance in a game session were observed. Nevertheless, these strategy-performance -links were pair specific. For example, when one pair benefitted from the use of metagaming in order to get a better score, the other pair showed no such connection. Interview statements linking experiences of gameplay to SRL in other learning contexts provided richer, although less salient, descriptions. In particular, skills pertaining to note-taking and peer learning were expressed. Additionally, participants were able to recognize in-game features that could be compared to learning skills in their own studies. However, judging by the questionnaire scores on self-regulation and metacognition in studying (MSLQ. Pintrich, 1991; A-SRL. Magno, 2010), there remain questions whether any true, transferable change has occurred in participants that could be attributed to the game sessions. This is highlighted in the fact that the motivation-related questionnaire data gathered in this study did not reveal any considerable changes in the mean level for the participants' motivation to learn in-game (IMI) or in their English self-efficacy (MSLQ & PALS). This is partly due to the limitations in the use of these questionnaires. Nonetheless, both individuals from pair 1 had an increase in some of these categories, as M1 experienced a visible growth on the value and usefulness subscales of intrinsic motivation, and as N1 had a marked rise in her English self-efficacy. The latter account is particularly substantial because it was observed that all participants were highly capable of comprehending the complex in-game English texts, opposed to the underlying hypothesis that the participants would profit from the extensive language exposure especially because they were part of the student well-being program (Student Life).

Our thematic analysis revealed a considerable number (16) of subcategories of SDT (see Figure 6), either supportive of or injurious to fulfillment of basic psychological needs. The subcategories create further understanding on the phenomena of competence, autonomy, and relatedness. More often than not, these categories were present on more than just one facet of self-determination. These subcategories can be simultaneously supportive and injurious; by yielding a negative impact on the gaming partner and endorsing the active individual at the same time. An example of this is one of the combined subcategories of autonomy and relatedness, obstinacy, which can result in added autonomy for the active player while reducing the relatedness to the gaming partner. This kind of an asymmetrical effect between the pair members can be seen in other combined categories as well, such as leadership, which, when done well, will create competence satisfaction for both members of the pair, but will most likely

only increase the autonomy for the active player. While working with the transcriptions, we noticed that multiple SDT-excerpts appeared partly harmonious to different facets of SRL, and to metacognitive strategies in particular. And although it wasn't investigated on a research question level, it was evident from our qualitative data analysis that some of the excerpts of metacognitive strategies were indeed overlapping with the excerpts of self-determination, albeit not necessarily forming exact mutual sections of transcription. This prompted us to illustrate the possible connections of self-determination to SRL, and led us to create an indicative Table (3), utilizing Pintrich's SRL-model (2000b, shown in Table 1) by fitting the discovered subcategories into a matching pair of phase and area of SRL. When the Table 3 is consulted alongside the Table 1, it illustrates how self-determination in a learning environment appears similar to SRL. When Table 1 is compared to the Table 2's classifications, it shows that the Control phase on the Cognitive and Behavioral areas were the most common sources of overlap between the transcriptions of metacognition and self-determination.

Table 3. Proposed framework combining different self-determination -affecting actions with Pintrich's (2000b) model of the phases and areas of SRL.

	Cognitive	Motivational/Affective	Behavioral	Contextual
Forethought, planning and activating	Leadership	Immersion & Indemnity against responsibility	Leadership	
Monitoring	Consensus & Transparency & Insight	Unresponsiveness & Considerate talk	Transparency & Leadership	Evaluation
Control	Leadership & Manipulation & Confrontation & Rejection	Obstinacy & Encouragement & Rejection	Negativity & Indemnity against responsibility	
Reaction & Reflection	Consensus	Rejection & Humorousness		Evaluation

Note that the phases of forethought, monitoring, control and reaction/reflection were considered exclusively on a micro-level; not taking into account moments outside of the gaming and interview sessions.

Questionnaire data revealed no notable changes in participants' need satisfaction throughout game sessions. Yet, this is not to say that psychological need satisfaction wasn't prevalent during gameplay, especially considering that the scores on this scale were relatively high following both the first and last game sessions.

In SRL, it is recommended that one person of the team can serve as an exemplary (pair 1) in providing modelling, feedback, and instrumental support, while in SSRL similar skill level in each team member (pair 2) is required (Hadwin, Järvelä, & Miller, 2011). One of the participants, M1, explicitly brought forth (during the individual interview) that he felt like being at an disadvantage, and also alluded to this at the final group gathering, where he mentioned that he learned a lot from his gaming partner (especially note taking skills) and that he was recommended to participate to the study after taking part in Student Life's reading comprehension tests. The fact that other participants did not share a similar background motivation in taking part in the study, leads into the asymmetry between the pair 1 and pair 2, and between the two participants of the first pair. The upside of this is that it allowed us to preview the different pedagogical mechanisms behind SRL and SSRL. But apart from M1's salient increase in internalized motivation for playing the game, no indisputable proof for "tutor-student" -pair's superiority to the peer pair in improving SRL -skills were found.

The small sample size, one peer -pair and one "tutor-student" -pair, didn't allow us to compare the pairs in great detail. But as the participants were very similar in their demographic and academic background (age, educational background, previous experience, in-game motivation, English self-efficacy, and general self-efficacy) and the participants within the pairs were unknown to each other and also of different gender, we feel confident in saying that a co-operative game setting holds promise in both types of pairs in prompting self-determination and SRL. In that sense, the pairs didn't differ, except in that the second pair had more excerpts of self-determination categories in two discovered subcategories of SDT, obstinacy and rejection, that were deemed harmful for one or for both participant's self-determination. As these differences in the quantities were so large between the two pairs on both researchers' privately done thematic analysis, this hints that the equality of gaming partners in pair 2 also raised the amount of competition between them, visible also in the numerous times they interrupted each other in all three gaming sessions. Thus, this finding seems legitimate, even after accounting for the evident personal factors and the deficits in the sample size.

By adding together the results of the study, they can be seen as uniform to many of the elements in the cyclical SRL model of Zimmerman (Zimmerman & Cleary, 2009); see Figure

1. The forethought phase includes metagaming as strategic planning, high levels of task value and interest based on the results from the IMI-questionnaire, goal attainment as was expressed and observed during the final group gathering, and the potential of the game to increase levels of self-efficacy, evident in the combined scores of MSLQ and PALS for both participants of the first pair. On the performance phase, the metacognitive strategies were appropriately varied according to the situation, matching some of the various needs of self-control and self-observation on Zimmerman's conceptual framework (Zimmerman & Campillo, 2003). On the self-reflection phase, some subcategories of self-determination come across comparable to self-evaluative judgements, as they create feelings of satisfaction and dissatisfaction by fulfilling (confrontation, leadership, humorousness, and considerate talk) or denying (rejection, manipulation, obstinacy, unresponsiveness, negativity, and indemnity against responsibility) the fulfillment of the needs of competence, autonomy, or relatedness. In addition, alongside the few mentions of metagaming done after play sessions from pair 1, the high levels of self-determination (even though the PENS scores of N1, M1, and N2 decreased marginally from after the first gaming session to after the third session, they still remained over ¾ of the maximum level from the full scores) might help to explain why participants were so willing to repeatedly engage in the game sessions for multiple hours; creating the cyclical phases of forethought, performance, and self-reflection at a grassroots level. This possible connection of self-regulated behavior to self-determination shows potential as an added way of understanding motivational factors in self-regulated performance. It would be productive for future research to investigate these associations (e.g. the ones shown in Table 3) on a more quantified level, e.g. factor analysis, or with careful attention to the precise transcription process, e.g. with the help of a revised protocol, allowing the clearly defined comparative analysis.

4.2 Strengths and limitations

This study approached its broad ambitions on promoting relevant 21st century skills with a novel take on gamiology from a wide range of different methods and through organizing the game sessions to be collaborative and in limiting the pairs to two members in order for each participant to have a proper chance to self-regulate in a self-determined fashion. These methods include transcriptions (on thematic and content analysis levels) of these spoken didactic moments and observations of metacognitive nonverbal behavior during gameplay, interviews on an individual level and group level, pre- and post-session questionnaires, and open-ended

questions on the perceived advantages of gamiology in a school environment. This mixture of different methodologies was a necessity, given the extensive research questions. In fact, we could have justified adding in, for example, checkpoints of goal attainment and to guide the participants' focus on learning SRL-skills. Yet this unobstructed and player-driven way of playing was considered to be a crucial factor in understanding what could be achieved with an apt game by itself. That way, we could determine how effectively one could use a collaborative detective board game, e.g. by incorporating it into a school environment without having to invest in any design-modifications to the game, teacher training, or expensive equipment. But even though the game is captivating, versatile, and challenging, as is demonstrated by its low and varied game scores and by its continued commercial success since its original launch in 1981 (reinvigorated by its new releases during the past few years), by itself, it was not sufficient to increase the participants' quantities of metacognitive strategies from the first gaming session onwards. The variety of the game in that each individual case presented novel problems that were crucial in solving the case, also hindered comparisons between different gaming sessions. However, this is only a concern for the purposes of research methodology. Apart from the mismatch of some of the used questionnaires, no method or research question went in vain. Put more broadly, we were able to have preliminary results on the various forms of self-related (McCombs, 2001) behavior (that also takes into account peers); such as shared strategies of metacognition, motivation, and self-determination (in a comprehensive manner) in a collaborative game-environment that seems capable of providing an engaging platform for learners' to develop their self-regulation skills. Thus, we can confidently say that through this process of a pilot study, we investigated important and relevant factors, from which many have the potential to act as guidelines for future research, as will be outlined in the paragraph of implications.

There are, however, few limitations to our study. First and foremost, the small number of participants in the study limited us to use mainly qualitative methods of attaining information about self-regulated learning and self-determination. This puts into question the generalizability of our results. However, we believe that our sample size was sufficient enough to capture the most general manifestations of self-determination and metacognitive strategies that could be witnessed in the general population of university students. This claim is supported by the fact that both pairs exhibited similar patterns of metacognitive strategy use in many of the strategy categories. The small sample size in our study limits our use and interpretation of questionnaire data to that of diagnostic measure of personal change in our phenomena of interest. Mean level change across all participants is thus inadequate to be hypothesized as a

general trend in either direction. However, considering the pilot research aim of our study, by demonstrating quantitative change in some participants' SRL-related skills and perceptions we would make a case for further and more extensive research in using gamification to enhance self-regulated learning. Considering our research as a tentative start in introducing also non-digital games into the field of education, our limitations pertain more to the other facets of SRL that we didn't choose to examine, such as performance attributions, rather than to the small sample size.

Another limitation to our study involves the use of modified questionnaires and their reliability. Our literature review revealed no studies on the Finnish translation and validity of any of our used questionnaires. Although almost all of our used questionnaires possessed internal consistency and validity, translation of questions always brings with it a danger of loss of validity and reliability. Also, modifications on performance domains assessed in some questions were made, further jeopardizing the validity of our questionnaires. In addition, no studies on the validity of Player Experience of Need Satisfaction were found. Future task for the creators of the scale should be to examine it in relation to other measures assessing psychological need satisfaction, such as the Basic Psychological Need Satisfaction at Work -scale (Deci et al., 2001). The questionable properties of PENS as a measure of need satisfaction in gamification context makes our qualitative taxonomy of self-determination that much more important.

Furthermore, limitations in using the in-game scoring mechanism to objectively assess performance during gameplay need to be considered. Although the in-game scoring was explained to both pairs prior to gameplay, we can say with no certainty that all players worked during game sessions to maximize their game score in place of enjoyment or exploration. Jackson, Dempsey, & McNamara (2011) warn against the potential of gamification to make players concentrate on the enjoyable features of the game instead of the explicit learning goals. However, this effect seems to be minimal based on the fact that both players used metagaming in order to decrease immersion and to increase their score.

One significant limitation of our study was the poor inter-rater reliability of some of the coded metacognitive strategies. Our coding key was adopted from the study by Azevedo and Cromley (2004) on the use of self-regulated learning in a hypermedia environment. Both the metacognitive strategies as well as the presence of basic psychological needs were examined by using audio transcriptions from the game sessions. This poor agreement in some metacognitive strategies use between researchers is in part a result of using audio data to assess partly visual phenomena. This is particularly true when examining cases of visual

representation or changing of information source, both of which require interpretation when assessed using audio data. Future research on learning in game environments needs to set clear theoretical and definitional outlines for each observed behavior of interest to avoid problems present in our study. Creating a framework supportive of study conditions in question is essential in achieving fit between anticipated and observed behavior. Observation of didactic and learning techniques is an intricate craft. Training people in the use of structured observation protocols in these contexts is challenging and time consuming (see Sawada et al., 2000).

Our method of observing metacognitive strategies by using participants' verbal and explicit statements bypasses participants' intrapsychic metacognitive strategies used in the game. The study by Azevedo & Cromley (2004) took this into account by using a think-aloud protocol to verbally elicit participant's internal thoughts and self-regulation strategies. Having a pair to work with requires making explicit some of the participants' inner talk, but this effect is arguably trivial in discovering the whole of a person's metacognitive strategies. Adding a think-aloud protocol would have most likely interfered with pair work in our study. A solution to examining intrapsychic strategy usage with multiple participants is tricky, but creating such an arrangement will most certainly allow fruitful endeavors in the area of collaborative problem solving.

Based on the observations of the researchers and the transcribed data, there seemed to be a difference between pairs in why and how the session was ended, potentially impacting game scores and their interpretation. For the most part, pair 2 were lively and action-oriented throughout game sessions, to the degree where the researcher had to at times point out to them to wrap up their investigation. Pair 1, in turn, agreed to stop investigating of their own accord through all sessions. This stop was sometimes due to them having enough information, and sometimes due to perceived standstill in progress. Apart from game session 1, game times of both pairs were rather similar, suggesting that the session scores were mostly independent of the time pairs had to solve each case. Even then, it may be possible that given enough time to work, pair 2 would have gotten better scores in their sessions, potentially changing our interpretation of metacognitive strategy usage. Giving pairs unlimited time to finish each session would have been problematic as well, because participants may not have been able to play for as long as they would have liked due to their other commitments in life. Also, managing time during studying is an important SRL skill (Pintrich, Wolters, & Baxter, 2000) and this skill would have been much harder to assess, were the sessions free of time pressures.

4.3 Implications

A few reasons lead us to be able to recommend *Sherlock Holmes Consulting Detective.* Besides being a game that is likely to be enjoyable for anyone as a commercial product as is evident by the participants continued and unfaltering motivation to engage in ten hours of gameplay, it has the potential to fulfill various individual needs. These include the self-determined behavior and the capability to provide meaningful learning experiences on English language, metacognition, teamwork, and note-taking. As the number of participants in a group grows higher, each individual's autonomy may suffer (Langfred, 2000), which raises the difficulty of designing a collaborative or competitive game to a traditional school environment. Since the COTS-game used in this study, *Sherlock Holmes Consulting Detective,* was played in a 2-player setting, it had an easier job of handling the various psychological needs, especially autonomy, of its players in both pairs. Consistent with Gee's listing of the requirements of a "good" game, the game can be intellectually seen as matching all 13 of the mentioned items, which is remarkable as the list was originally developed to conceptualize the potential of digital games (Gee, 2005). Every participant mentioned them being highly interested towards the game during the individual interviews, which were done at the end of the third gaming session. This is in line with the fact that every gaming session lasted at least three hours, without any significant signs of observed boredom. Instead, a researcher's intervention (notifying the remaining time) was necessary on two occasions on the first and also in the third gaming sessions of the second pair, as they would have otherwise played overtime (over the scheduled four hours). This observation of losing the track of time alludes to the flow experiences (Csikszentmihalyi, 1975) of both pairs, but especially in the second pair's case, possibly hinting at the added engagement of having an equal pairing enhancing the competition in collaboration. Also, the metacognitive strategies that were chosen for this study continued to be present throughout all gaming sessions, suggesting that the participants experienced a high motivation to learn more in their trajectory towards expertism (Foster, Esper, & Griswold, 2013). In addition, the identical rank order of metacognitive strategies between the two pairs further backs our claim on the game's impact to its players. Thus, we can recommend *Sherlock Holmes The Consulting Detective* also as a board game alternative to instruct SRL-skills to college level students, and especially to students who are at a risk due to disadvantaged backgrounds (e.g. Tominey & McClelland, 2011) to have their studies prolonged or abandoned (Ting, 1998; Zimmerman, Moylan, Hudesman, White & Flugman, 2011).

As the participants were able to note the similarities between the impactful gameplay to the academic environments, the question then becomes more on the front of usability; how should we try to implement a similar game to a more traditional school environment? Based on our results, a possible way of incorporating *Sherlock Holmes The Consulting Detective* or a similar board game to a school environment, would be to have it available in special education programs where e.g. a tutor-student would be one of the players, but by consciously taking a smaller role in-game, instead focusing on providing alternatives through modelling various ways of approaching the issues. An important aspect would be to follow the gaming session with discussions on how the gameplay is comparable to school, and what elements could be taken from beneficial gaming strategies to assist learning in other contexts. Care must be taken to guide and give competence feedback to the student in a way that is autonomy-supportive and not controlling so as to cultivate intrinsic motivation (Frederick & Ryan, 1995; Deci, Koestner, & Ryan, 2001). When compared to other ways of SRL-instruction (e.g. Azevedo & Cromley, 2004; Zimmerman et al., 2011), the game-based intervention would be less demanding for the tutors, as the only requirement is for the expert to know the simple rules of the game (Schmitt, McClelland, Tominey, & Acock, 2015). In addition, as shown in a game-based SRL-instruction setting aimed at preschool aged children (Schmitt et al., 2015), the low-income, non-native English Language Learning (ELL) intervention group gained significantly in their math scores from a SRL-instruction, when compared to the ELL-control group. However, the other results revealed no significant changes in SRL-skills or academic achievement, possibly alluding that the utilized games, which, even though have been specifically designed to develop SRL-skills, weren't able to impact players' relevant SRL-skills as they prompted concepts such as working memory, attention, and inhibitory control (for the development of these games, based on well-known music and movement-related games, see Tominey & McClelland, 2011). In any case, this increased or early exposure to a foreign language, as is the trend in language training (in Finland, English is currently taught from the second grade onwards), would add value to the intervention particularly when SRL would be taught in an elementary school level. Our hypothesis is that it would actually be best if this expert would not have played the case beforehand, so that the gameplay would be engaging for all participants (expert included), leading to a more co-regulated motivation so that the intrinsic motivation in gameplay would not diminish, and encouraging the at-risk students to part from the ways of the expert to emphasize his or hers individual assets. The amount of social support from the expert should be systematically reduced as the learner continues to work on the different levels of SRL-skills from social to self; e.g. on a motivational

level from requiring vicarious reinforcements (observation) to direct/social reinforcements (emulation) to self-reinforcements (self-control) to self-regulation of self-efficacy beliefs (Zimmerman, 2000), that adapt their performance to the changing environmental and personal conditions (Zimmerman, 2013). This frame would be an apt way to study the possibilities of creating an intervention method from the *Sherlock Holmes Consulting Detective*, or any similar co-operative detective board game, such as the upcoming games of *Detective: A Modern Crime Board Game* (2018) or *Chronicles of Crime* (2018), which both have the benefit of incorporating hypermedia as a vital source of information. Although they are also COTS-games, both of them have relation to Azevedo's and Cromley's (2004) suggestion for designers to incorporate a hypermedia environment. Chronicles of Crime even has a Virtual Reality element in it, while still being arguably the easiest of the three with its maximum of 90 minutes of play duration. We hypothesize that a similar game could relatively simply be re-themed and re-designed around a scientific topic, with the specific pedagogical learning goals in mind. If such an endeavor would be attempted, it should be done while having a wide holistic pedagogical perspective towards the game having enough varied content, and that the game would be able to keep offering educational experiences past the initial learning (Foster et al., 2013).

In conclusion, our pilot study of a commercial off-the-shelf board game *Sherlock Holmes Consulting Detective* as a SRL -enhancing aide found a similar pattern of metacognitive strategy use for both pairs for many of our categories of interest, but these patterns weren't correlative of performance. Participants found the game sessions somewhat beneficial to their note-taking and pair-working skills, and noted many similarities between playing the game and studying in an academic setting, although any long-term effects of the game are uncertain. Our study found many ways in which self-determination was endorsed or obstructed, some of which may be more closely linked to aspects of self-regulated learning. This pilot study highlights novel insights on this connection, as well as to what subcategories are relevant under the categories of SDT; competence, autonomy, and relatedness. In addition, as under the influx of technological advances face-to-face interactions are looking somewhat endangered or limited, this study breaks ground about the possibilities of a learning platform that is non-digital but still game based. The potential of the game as a motivational tool showed some efficiency. However, these changes were either moderate mean level changes or individual changes, leaving room for more elaborate and statistically sound research methods. These preliminary results encourage further inspection towards adapting commercial off-the-shelf -games similar to *Sherlock Holmes Consulting Detective* to be used to cultivate self-

regulated learning strategies in students, particularly those having deficients in these skills. Future research on this issue would benefit from a larger sample size, more objective outcome and performance measures, and more salient application to educational settings.

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APPENDIX A: Guideline of rules explanation for *Sherlock Holmes Consulting Detective* - board game, and footage of the game components. The guideline was used as a frame of reference for the researchers to help explain the rules of the game.

SHERLOCK-PELIN SÄÄNTÖSELITYS

Tervetuloa **Viktoriaanisen ajan Lontooseen!**
Sherlock Holmes ratkaisi rikoksia parinkymmenen vuoden ajan. Hän ei kuitenkaan kyennyt tähän yksin, vaan hänen apunaan toimi Watson, Wiggins, ja Wigginsin ryhmä nimeltään "Baker Street Irregulars", mitä pelaajat edustavat tässä pelissä. Te olette nyt osa tätä rikoksen ratkaisua, ollen **yhteistyötä tekevä etsiväpari**!

Pelilaatikko pitää sisällään 10 eri rikosmysteeriä, ja **1 pelikerta koostuu**kin tämän **yhden rikosmysteerin** ratkaisemisesta. Tarvitsette rikosmysteerin ratkaisemiseen: **rikosvihon, Lontoon osoitekirjan** (missä on jokaisen lontoolaisen osoite), **Sherlockin tietolähdeluettelon** - mikä löytyy sääntökirjan takasivulta -, **rikospäivän sanomalehden**, missä on sekä aiheeseen liittymätöntä että rikokseen mahdollisesti kytkeytyvää materiaalia, **sekä Lontoon kartan**.

Lontoon kartta koostuu viidestä eri naapurustosta, luoteisesta Lontoosta (North West, NW), läntisestä keskustasta (West Centre, WC), lounaisesta Lontoosta (South West, SW), itäisestä keskustasta (East Centre, EC), ja kaakkoisesta Lontoosta (South East, SE). Tähän naapurustoon viitataan tällä kirjainlyhenteellä ja siihen yhdistetyllä viitenumerolla niin kartassa, rikosvihossa, osoitekirjassa (mistä löytyy jokaisen lontoolaisen osoite), kuin myös sääntökirjan takakannesta löytyvästä tietolähdeluettelossa, minkä antamat tiedot asiantuntijoiden palveluista voivat mahdollisesti auttaa tietyissä rikoksen ratkaisemiseen liittyvissä pulmissa. Esimerkiksi Sherlockin Baker Street -sijaintiin kannattaa mennä, jos koette olevanne jumissa. Pelikartan oikeassa alareunassa on **jana**, minkä avulla voitte hahmottaa rikosepäiltyjen liikkeiden ajallista kestoa. Teidän liikkeitä ei mitata aikajanalla, eikä se vaikuta teidän liikkumiseen.

Jokainen rikosmysteeri tuo tullessaan myös oman **rikosvihkosen**, missä on tapauskohtainen **mysteerin esittely ja pelaajat vauhtiin asettavat johtolangat.**

Rikosvihkosessa on aina tietoa tietyistä, rikoksen ratkaisemiseen jollakin tavalla liittyvistä, Lontoon sijainneista. Teistä aina toinen on viimeisenä vastuussa siitä sijainnista, mitä he yhdessä menevät kulloinkin tutkimaan. Tämän päätöksen jälkeen onkin sitten sen toisen pelaajan vuoro toimia "**johtavana rikostutkijana**". Jos johtava rikostutkija päätyy sijaintiin, mihin ei liity tietoa, tulee tämäkin silti kirjata ylös vähintään toisen pelaajan toimesta journaaliin, koska jokainen teidän vierailema sijainti kuvastaa rikosetsivien aikaa kyseisen johtolangan perässä. Tämänkin jälkeen johtavan rikostutkijan vuoro vaihtuu. Johtava rikostutkija voi halutessaan lukea ääneen rikosvihkosesta aukeavan tekstin pätkän, tai te voitte vaihtoehtoisesti lukea sitä yhdessä katsoen. Vaikka päätös seuraavasta oleellista tutkittavasta rikospaikasta on johtavan rikostutkijan harteilla, on teidän silti edullista työskennellä yhdessä tämän päätöksen edessä. Olkaa kuitenkin varovaisia, sillä jokainen käyty paikka vaikuttaa negatiivisesti pisteisiin. Voitte myös aina lukea sanomalehteä, asukastietoluetteloa, tietolähdeluetteloa, ja palata sijainteihin tai alun opastavaan tekstiin, minkä olette jo aiemmin käyneet läpi. Tällaista aiempaan tietoon palaamista ei tarvitse kirjata ylös journaaliin.

Journaaliin voi kirjoittaa mitä vain, koska vain, kumman tahansa toimesta. Voitte myös pitää itsenäisesti vapaamuotoisia muistiinpanoja.

Kun koette, että olette ratkaisseet mielestänne riittävän perusteellisesti rikoksen, **voitte yhdessä päättää pelin**. Tällöin pääsette avaamaan rikosvihon viimeisen aukeaman, mistä avautuu lista rikokseen liittyviä kysymyksiä, joihin teidän tulisi nyt yhdessä pystyä muistiinpanojensa perusteella vastaamaan. Tämän jälkeen, rikosvihkosen toiseksi viimeisellä aukeamalla, **Holmes** kertoo nerokkaan tapansa, miten hän ratkaisi rikoksen. Lopuksi avaatte rikossivun viimeiseltä aukeamalta löytyvän kirjekuoren, minkä avulla pystytte laskemaan pelikertanne pistemäärän, Holmesiin verraten. Holmes on erityisen haastava päihitettävä, ja pelaajien pistemäärä voikin olla hyvä, vaikka se olisi vähemmän kuin Holmesin 100 pistettä. Rikosvihon kahta viimeistä aukeamaa ei tulisi katsoa ennen kuin olette valmiita lopettamaan etsivän työn tämän rikoksen ja pelikerran osalta.

Seuraavaksi käyn vielä läpi lyhyen ja havainnollistavan **tutoriaalin**. (Tutoriaalissa yhden johtolangan luona käyminen sekä Scotland Yardin jututtaminen hypoteesinomaisesti, plus journaali)

APPENDIX B: Interview frame for the last game session interview

Viimeisen pelikerran kyselyt

- Mitkä ovat päällimmäiset tunnelmasi pelikerroista?
- Miten koet onnistuneesi olennaisen tiedon etsimisessä ja löytämisessä pelikerroilla?
    - Koitko tässä muutosta, kun peli tuli tutummaksi?
- Muuttuivatko lähestymistapasi pelin ongelmiin pelikertojen aikana?
    - Jos muuttuivat, niin millä tavoin?”
- Huomasitko niitä tilanteita pelissä, jossa keskityitte vääriin asioihin?
    - Mitä teitte näissä tilanteissa?
- Millaisia ongelmanratkaisutapoja huomasit käyttäneenne pelissä?
    - Mihin muihin tilanteisiin tuollaisia ongelmanratkaisutapoja voitaisiin käyttää?
- Koetko että pelikerroilla on ollut jotain vaikutusta englannin kielen taitoihisi?
    - Millaisia?
- Miten koet pelimateriaalin englanninkielisyyden vaikuttaneen pelaamiseesi ja osallistumiseesi?
- Mitä arvelet, miten pelaamisesi ja osallistumisesi olisi muuttunut, jos materiaali olisi ollut suomen kielellä?
- Kuinka hyvin koit pystyväsi ilmaisemaan mielipiteitäsi parillesi pelikertojen aikana?
- Kuinka oma-aloitteisesti pystyit ratkaisemaan ongelmia ja saavuttamaan oivalluksia pelikertojen aikana?
- Kuinka hyvin pystyit tukemaan pariasi haastavissa tilanteissa pelikertojen aikana?
    - Entä kuinka hyvin koit parisi pystyvän tukemaan sinua haastavissa tilanteissa pelikertojen aikana?

APPENDIX C: Questions presented to the participants in the final group gathering

- Keskustelkaa yhdessä päällimmäisistä ajatuksistanne pelikerroista. (Entä miten koitte suoriutuneenne parina, ilmaiskaa toiselle parille.)

- Mihin tilanteisiin mielestänne yhteistyö sopii?

- Millaisissa tilanteissa kokisitte hyödylliseksi toisen henkilön auttamisen oppimistilanteissa? Entä avun pyytämisen?

- Huomaatteko yhtäläisyyksiä auttamistavoissanne pelikertojen ja pelaamisen ulkopuolella, oppimisen kontekstissa?

- Mitä olette mieltä siitä, että jos pelikertoja olisikin ollut useampi kuin kolme?

- Pohtikaa yhdessä tutkimuksen mahdollisia vaikutuksia oppimistyyleihinne?

- Oletteko kokeneet tutkimuksen aikaista muutosta siinä, miten ilmaisette ajatuksianne?

- Miten koette pelaamisen vaikuttaneen suhtautumiseenne omiin ideoihin ja niiden arviointiin?

- Pohtikaa yhdessä, että mikä on hyvä tapa oppia. Onko jokaiseen tilanteeseen olemassa se paras tapa?
    - *Huomasitteko pelin aikana jonkun oppimistavan erityisen tehokkaaksi?*

- Pohtikaa yhdessä, että miten asioita tulisi kirjata itselleen ylös, jotta ne muistaisi tehokkaasti?
    - *Muovaantuivatko tapanne tehdä muistiinpanoja pelaamisen yhteydessä?*

- Kuinka usein käytätte kurssimateriaalin ulkopuolisia tietolähteitä opiskelussanne?
    - *Hyödynsittekö pelikomponenttien ulkopuolista materiaalia pelaamisen aikana?*

- Koitteko, että pelikertojen sovitut aikarajat vaikuttivat pelaamiseenne?
    - *Miten suhtaudutte aikapaineisiin opiskelussa?*

- Miten tulitte pelikerroilla siihen päätökseen, että tietoa on tarpeeksi rikoksen ratkaisemiseksi?
    - *Entä miten tiedätte työskennelleenne tarpeeksi kurssia varten?*

- Koitteko pelikertojen muuttaneen käsitystänne itsestänne opiskelijoina?

- Muovaantuiko suhtautumisenne opiskeluun tutkimuksen kautta?

- Kertokaa avoimesti, että miksi osallistuitte tutkimukseen?